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ABSTRACT

This document presents the proceedings of a conference on managing and using information technology in higher education in regard to client/server computing, network delivery, process reengineering, leveraging of resources, and professional development. Eight tracks, with eight papers in each track, addressed the themes of: (1) strategic planning; (2) policies and standards; (3) serving clients with client/servers; (4) rethinking user services; (5) new technologies; (6) networking and telecommunications; (7) professional development; and (8) academic computing and libraries. In addition, the document contains a summary of a focus session on information technology staffing issues and a summary of conference evaluations by 386 attendees. (MDM)

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CAUSE

Realizing the Potential of Information Resources:

Information, Technology, and Services

Proceedings of the
1995 CAUSE
Annual Conference

November 28–December 1, 1995
New Orleans Hilton

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CAUSE
95
New Orleans
Nov. 28 - Dec. 1

Realizing the Potential of Information Resources:

Information, Technology, and Services

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INTRODUCTION

by Jacqueline Brown
CAUSE95 Chair

Dear Colleagues:

When the CAUSE95 committee selected the theme *Realizing the Potential of Information Resources: Information, Technology, and Services,* we wanted to encourage sharing of successes brought about by the latest developments in our profession. We were fortunate to receive a record number of proposals, from which we were able to schedule a variety of sessions to tell of issues faced, challenges met, and partnerships forged in areas of keen interest—client/server computing, network delivery, process reengineering, leveraging of resources, professional development.

Every program committee has the opportunity to build on the successes of past conferences. In response to many expressions of interest in one-on-one interactions, we enhanced this year's poster sessions to facilitate such communication by grouping poster booths according to the eight subject tracks, and asking many of the lecture-style speakers to present related poster sessions as well.

Other exciting features of this year's conference included

- general session speakers who reflected the importance CAUSE places on service and on the development of our profession
- a Current Issues Forum where industry and higher education leaders examined the growing importance of information resources in the next century
- an expanded corporate demonstration area
- opportunity to explore the World Wide Web and other wonders of the Internet
- picturesque New Orleans, the magnificent Mississippi River, and Cajun Southern hospitality

CAUSE95attracted a record number of participants— nearly 2,300 attendees from the U.S and 12 other countries, a 6 percent increase in attendance from 1994. This printed Proceedings will serve as a reference for those attendees and will also provide to those who couldn't join us in New Orleans a sample of the wealth of information available at CAUSE95.

(Please note that the papers contained in this printed Proceedings are also available online via the CAUSE Gopher and Web servers. See the copyright page for details.)

Jacqueline Brown

Jacqueline Brown
Princeton University
CAUSE95 Chair

CAUSE gratefully acknowledges the enthusiasm, time, and efforts of the CAUSE95 Program Committee, and the generous support of their institutions: Jacqueline Brown (chair), Princeton University; Linda A. Chiappe (vice chair), Emory University; Charles R. Blunt, SUNY Central Administration; Gilbert Dionne, Université du Québec à Montréal; Susan J. Foster, University of Delaware; Fritz Hibbler, University of Idaho; Douglas E. Hurley, University of Kentucky; Vijay Kumar, Mount Holyoke College; Mary E. McClure, Brown University; Kären Nagy, Stanford University; Jack T. Tinsley, Florida Community College/Jacksonville; June Winckelmann, Syracuse University; Cliff Woodruff, Tulane University; and Sue Ellen Anderson, Educom liaison.

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TRACK 1

STRATEGIC PLANNING

Coordinator: Fritz Hibbler

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Can Small Colleges Afford To Be Technology Leaders?

Can They Afford Not To Be?

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Computing & Information Services
and Associate Dean of the Faculty
Reed College
Portland, OR

David Smallen, Director
Information Technology Services
and Institutional Research
Hamilton College
Clinton, NY

Abstract

Small colleges, troubled by demands on financial aid, constrained by external pressures to limit the growth of tuition and fees, and driven by increased competition for students, appear poorly positioned to be technology leaders. However, in these difficult times they have opportunities to distinguish themselves through focused applications of information technology resources in support of their missions. Taking a leadership role in technology can have significant payoffs as well as substantial risks. In this paper we examine both the costs and benefits of technology leadership for small colleges.[1]

---

[1] Questions or feedback about the paper is welcomed and should be directed to Martin Ringle at ringle@reed.edu or David Smallen at dsmallen@itsmail1.hamilton.edu.

Institutional Characteristics and Technology

It is important to note that over sixty percent of all institutions of higher education have less than 2,500 students and that small colleges differ from large universities in numerous ways. One of the more important distinguishing characteristics of small colleges is the scarcity of resources they can apply to the pursuit of technology goals. While all institutions of higher education are challenged by the cost of technology, smaller institutions are unable to achieve the economies of scale available to large universities hence they are especially hard-pressed to provide adequate staff support, network enhancements, software customization, and equipment replacement to maintain campus-wide technological currency.

Of equal importance, however, is the fact that small colleges generally emphasize teaching and learning as central features of their institutional missions, while placing less importance on the role of faculty research. Even at selective liberal arts colleges, where the scholarly activities of the faculty are rewarded through tenure and promotion, support for new technology is rarely a top institutional priority. Research universities and other institutions, by contrast, take great pride in their applied research achievements and the creation, acquisition, or deployment of the latest technology.[2]

In a climate of scarce resources and with technology a comparatively low institutional priority, it is not surprising that both the faculty and the administration of many colleges believe that this type of leadership must be found elsewhere. Indeed, when strategic questions about technology arise, small colleges commonly look to large universities for solutions.

The Problem with University Paradigms

The difficulty with seeking technology models elsewhere, however, is that solutions which are appropriate for institutions like Cornell University or the University of Washington do not easily scale to colleges such as Hamilton or Reed. This is true for almost every aspect of technology deployment and support, from methods of funding and equipment allocation to strategies for the development of administrative information systems. There are, of course, exceptions: a graphics workstation for undergraduate chemistry instruction may be equally suitable at Ohio State or Oberlin. In most cases, however, technological solutions at small colleges cannot be obtained by simply "shrinking" the approaches taken by large universities. The list of technical and organizational differences is a long one; consider just a few examples:

In a large university administrative data processing operations often support a multitude of fiscally autonomous and semi-autonomous organizations. The complexity inherent in these types of environments typically demands institution-specific financial management software and, not unexpectedly, a programming staff of considerable size. Small colleges, by contrast, tend to have unified, top-down financial organizations, which neither require nor can afford a large staff of programmers. As a result, small colleges tend to rely more on relatively low-cost, off-the-shelf, integrated packages that need little customization and (at worst) a modest-sized programming staff.

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[2] Some of the most widely used software packages in higher education were developed, with extensive institutional support, at research universities. For example: B.S.D. Unix (UC Berkeley), X-Windows (M.I.T.), Gopher (Minnesota), and Mosaic (Illinois).

Likewise, consider the differences in networking. Computing organizations at large, multi-campus universities often view networking primarily as the provision of backbone services to a hegemony of "LAN fiefdoms." Promoting university-wide protocol standards and maintaining interfaces for e-mail packages and other inter-group software tools, is a full-time challenge. Small colleges, on the other hand, are far more likely to be responsible for designing and maintaining networking for the entire institution. Much of the large-university complexity brought about by interoperability demands is simply absent. As a consequence, many of the hardware, software, and staffing solutions suitable for a large university network are simply irrelevant to small institutions.

Further, universities have a long history of using technology fees and chargeback mechanisms to fund computing services, and restricting computing access to students in particular courses. These practices are foreign to small institutions which generally finance educational programs through tuition charges and institutional funds.

Thus in many cases small colleges must seek technology leadership within their own ranks, or look to collaborative relationships with universities or peer institutions for workable strategies.

Some Opportunities for Technology Leadership[3]

Technology leadership defies precise definition. The most obvious type of leadership, the creation of new software or hardware technologies, is beyond the scope of most small colleges. Rarely can these institutions devote significant professional staff or financial resources to such endeavors. The result is that the impact of software development is usually confined to a small number of courses and disciplines at a modest number of schools. Further, hardware and software incompatibilities have limited the portability of such software to other institutions.[4] Traditionally, therefore, the development of new technology has not been an easy avenue of leadership for small colleges.

The World Wide Web – The recent incredible growth of activities on the World Wide Web augurs a significant new opportunity for small colleges. Unlike earlier generations of software, preparation of Web materials may be accomplished without requiring a major investment in a large professional staff. The Web allows faculty at different institutions to build upon the work of others, often collaboratively, to enhance the learning environments for their students. This is a particular opportunity for small colleges because of their emphasis on teaching and learning. Further, the relative hardware and software independence of Web activities makes this collaborative process feasible for virtually any college. During the next two or three years, development of Web materials is likely to provide unprecedented opportunities for small colleges to exercise technology leadership, individually and in collaboration with others.

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[3] Additional opportunities for leadership are implied in the *Evaluation Guidelines for Institutional Information Technology Resources* (HEIRA, 1995).

[4] In spite of these hurdles, however, faculty at several small colleges have created instructional software of distinction, that has won national awards and enjoyed broad dissemination.

Curricular applications of technology – While large universities excel in many ways, most education professionals agree that the highest quality undergraduate instruction is found in small colleges. Using this as a foundation, small colleges can play a leadership role by finding ways to innovatively apply available technologies to enhance teaching and learning. A technology leader in this regard uses technological resources in new ways to address different learning styles, illuminate difficult concepts, accelerate the acquisition of knowledge, and prepare students for a lifetime of learning. For example, the Reed chemistry department has redesigned large parts of its curriculum to incorporate computational research tools. Molecular modeling packages such as SPARTAN and Midas, together with visualization software developed at Reed, are being used to enrich students' understanding of basic principles of molecular behavior. Many other departments at Reed, from biology to classics, have used available software packages to promote a higher degree of independent student research.

Hamilton College has likewise been involved in curricular technology initiatives in a number of departments. Its economics department is using simulation software developed at the University of Arizona to help students learn about economic markets through multi-person games. A Hamilton anthropologist and his students participated in Project Solsys[5] to design a space station by collaborating with students at other colleges via the Internet. And members of the Hamilton biology department have been using the BioQuest[6] library, a compendium of computer-based tools, simulations and textual materials that supports collaborative, research-like investigations in biology classrooms and laboratories.

Institutional efficiency – Operating in an efficient manner helps to reduce the costs of achieving the institutional mission. The use of technology has become almost mundane in the daily operations of higher education institutions — we can't imagine how we could do business otherwise. However, truly innovative applications of technology which redefine, in some sense, the way business is done, are still rare and characteristic of strong leadership. Technologies which enable us to do more effective student recruiting, to track prospective donors with more precision, or to analyze financial aid requirements more reliably, without adding staff, help colleges operate more cost-effectively.

At Hamilton, for example, career services has been substantially transformed by using Web technology. All recruiting opportunities for students are published on the Web. On an average day, more than 30 changes are made in contact persons, telephone numbers, deadline dates, etc.. Over the course of the semester, using the Web allows career services personnel to reinvest hundreds of hours of staff and student time while making information about recruiting available to students any time of the day or night. But perhaps, the most exciting change is Hamilton's involvement in a cooperative venture to share the expertise of career services personnel – nationwide – through a Web effort called the Catapult.[7] These activities not only promote efficiency, but improve the quality of services provided.

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[5] Project SOLSYS is coordinated by Northern Arizona University.

[6] The BioQuest project is coordinated by Beloit College.

Access to electronic resources – While some traditional metrics, such as the total number of computers on a campus, may be little more than public relations fodder, the ability to provide students, faculty, and other members of the college community with excellent access to electronic resources presents a genuine opportunity for leadership. Institutions can achieve a good deal of recognition for providing high-speed, reliable, and secure network access from anywhere on campus, including offices, classrooms, labs, dormitory rooms, the library, and so forth. Increasingly, colleges are also providing friendly means of off-campus access to faculty, alumni, parents, donors, and others associated with the college. Swarthmore and Trinity University (TX) have both received national attention for their innovative approaches involving electronic services for alumni.

Organizational innovation – In an era characterized by so many changes and challenges, colleges need to have information technology organizations that are nimble, fluid, and maximally responsive to users' needs. The days of isolated departmental units for academic computing, administrative computing, telecommunications, audio-visual technologies, library resources, and the like are gradually disappearing. Colleges are recognizing that all technologies and information resources need to be tightly coordinated in order to achieve optimal institutional strategies. Gettysburg College, for example, has taken a bold step in creating an organization where all library and technology resources report to a vice president for strategic information resources. While this may not be an appropriate solution for all small colleges, it does demonstrate technology leadership in the realm of organization.

Infrastructure – Creating and maintaining a modern technical infrastructure is a resource intensive activity, often beyond the means of small institutions. Even among institutions with considerable financial resources, the expectations for the quality of the hardware, software and networking environment often exceed the institution's capacity. However, there are a number of strategies that small colleges can use to enhance the likelihood of distinction in the creation of an excellent infrastructure, and to maximize the institutional investment in it.

Controlling the diversity of hardware and software will minimize support costs, particularly the staff resources necessary to answer questions, provide training, and assist with upgrades. Adhering to established standards and mainstream products across the entire institution make it more likely that the infrastructure can be efficiently managed. These are particular opportunities for small colleges that are often unavailable to large universities.

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[7] See the *Chronicle of Higher Education*, July 14, 1995.

Fiscal strategies for technology – As any college financial officer knows, the cost of technology is one of the major "black holes" of the institutional budget. Colleges that establish creative ways of dealing with technology funding clearly have an opportunity to exercise significant leadership. For example, Hollins College provides a model of how to reduce the cost of campus networking by forming a partnership with a local cable TV provider. Institutions, like Reed, that have managed to increase the availability of computer resources while maintaining a constant technology operating budget level also play a leadership role.

Benefits and Risks of Technology Leadership

Pursuing a technology leadership position has both rewards and risks. Many small colleges pointedly avoid being in the technological vanguard and prefer instead to be "early followers" or simply to remain "near the median." We explore some of the potential benefits of pursuing technological leadership and then examine some of the risks associated with being on the "bleeding edge."

Benefits

Enhanced learning environment – Without question, the most compelling benefit of being a technology leader is to provide students with the best possible opportunities for learning. This is clearly the primary motivation behind Reed's innovative use of technology in biology and chemistry instruction, of Mill's use of advanced technology for music composition and synthesis, and of Hartwick's practice of providing every entering student with a personal computer. If the overriding goal of a small college is to offer students the best possible environment for learning, then being a pioneer in instructional uses of technology can help to achieve that goal and thus to underscore an institution's curricular strengths.

In the coming years, as enrollment and financial pressures on small colleges mount, it will become increasing critical for these institutions to distinguish themselves from one another by more than geography, architecture, or cost; successful institutions will be those that are perceived as having particular unique — or at least highly competitive — programs in specific curricular areas. Some in higher education believe that in addition to having the best faculty, colleges will also need to have the best information resources and technology in order to justify claims about disciplinary strengths. They further believe that being a technology leader in this regard is — or will soon be — a prerequisite for instructional excellence, hence a key component for fulfilling one's institutional mission.

Campus-wide services – Basic to the integration of technologies into the campus environment is providing excellent support services. Institutions can demonstrate technology leadership in the way they provide services that address important needs in the campus community. Thus, for example, Occidental College has provided students with a graphical utility for remote registration which is friendly, efficient, and radically superior to the traditional methods of registration. Others colleges that have reviewed the Occidental approach view it as a valuable model for the design of their own registration systems. Hamilton's collaboration with Cornell University's

Institute for Social and Economic Research (CISER) has provided faculty and students with access to vast social science databases and the expertise to use them — access and skills that would otherwise be unavailable in a small college setting.

Attracting outside funding – During the 1980s individuals, private foundations, and government agencies provided substantial funds to allow colleges to take advantage of new technologies. While the availability of such funding has declined, and competition for it has increased, there are still many opportunities to obtain sizable grants. Many technology grant decisions, however, are based on the likelihood that the recipient will be capable of doing something truly innovative and that other colleges will be interested in the results. Establishing a reputation as a technology leader, in almost any of the categories mentioned above, can help an institution to attract external funding. Reed, for example, by serving as a model of technology innovation among liberal arts colleges, has received millions of dollars in grants in the past ten years to underwrite substantial portions of its network, microcomputer labs, advanced workstation facilities, software acquisition, library automation system, and other electronic resources. Likewise, Hamilton (in conjunction with Colgate University) recently received a Mellon Foundation grant for infusion of information technology into modern language instruction. The award was based partly on each institution's commitment to work collaboratively as a way to maximize the use of electronic resources.

Developing favorable relationships with technology vendors – A similar benefit applies to vendors of software, hardware, and services. While the prolific equipment grants of the 1980s, like foundation funds, are no longer abundant, there remain numerous opportunities for a college to acquire new technology at little or no cost by having a reputation as a technology leader. Recognizing the ongoing importance of "reference sites" among different sectors in higher education, vendors continue to be willing to make special allowances for schools that are perceived to be leaders in one area of technology or another. In addition to grants and deep discounts, technology leaders also benefit from favorable vendor relationships by learning of new products early in the development cycle and, in some cases, by having input into both product and marketing strategies. Technology leaders which are invited to participate in focus groups or educational advisory boards, or who serve as beta- or early-support-sites, may play a small but nonetheless important role in shaping the direction of future educational technologies.

Recruiting – Using technology to improve the learning environment, the quality of campus life, extra-mural funding, etc., may contribute to the ability of a college to attract and retain outstanding students and faculty. Several years ago, the claim that a decision of whether or not to attend or work at a particular college was based on the availability of electronic resources was most likely the product of a chief information officer's overworked imagination. Today this is no longer true. At Reed, for example, prospective students (and their parents) frequently inquire about dormitory networking, electronic library resources, access to the Internet, etc., during the application process or a campus visit. Likewise, prospective faculty members often raise detailed questions about electronic resources they may require for instruction or research purposes. While a variety of other factors are undoubtedly critical to the decision of whether to attend or work at a particular college, the lack of sufficient technological resources may be instrumental in a decision not to attend (or work at) an institution.

Service to peers – Finally, we must recognize that when a small college investigates a new technology, organizational structure, or fiscal strategy it enables other colleges to evaluate the results without putting themselves at risk. In the words of a familiar truism, "it's a dirty job...but somebody's got to do it." By taking the lead in a particular area of technology, colleges help one another to define collective technical strategies.

Risks

Along with the opportunities and possible benefits of technology leadership come risks. Small colleges, in choosing an information technology leadership strategy, must do so with a full assessment of the possible risks — that is, with their eyes wide open. Given the constrained financial environments these institutions face, resources must be invested wisely, and technological applications are but one investment opportunity. Further, leadership is not an all-or-nothing concept; colleges have the choice to lead in some areas and not others.

Underestimating support requirements – The most fundamental barrier to technology leadership is the lack of adequate support staff. A robust infrastructure (e.g., hardware, software, networks), often a central part of a leadership environment, must be supported by substantial staff resources. These are usually difficult to provide when institutional staffing levels are constrained and institutions are trying to find ways to reduce operating costs. Institutions commonly focus on the creation rather than the maintenance and support of a campus infrastructure, since this is generally what foundations and vendors will fund. Seeking "soft" funding for leadership activities can encourage institutions to think of technology acquisitions as "one-time" expenditures. Vendors, unfortunately, encourage this thinking, since they are generally interested in the short term promotion of their most recent products by the institution. The immediate result is often large infusions of hardware and software to campuses, with only short-term support from vendor personnel. The end result can be disappointment when continuing staffing needs become apparent.

Infrastructure needs are also driven by factors outside of the institution's control. For example, the release of a new version of an operating system may create broad incompatibilities in the computing environments of colleges and universities. While ultimately, these changes may be beneficial to the institution, short-term problems can result. Since much of the new hardware (and related software) is ordered by colleges during the summer months, support staffs are forced to scramble to prepare for the arrival of machines that will not work with existing software applications and network operating systems. In many cases, institutions that standardize on a particular operating system to reduce costs have to deal with major problems just when an academic year is about to begin. The result is serious, sometimes overwhelming stress on support staff

Finally, corporate mergers and takeovers, which have accelerated in recent years, can cause further instability in support costs. Institutions that make major investments in leading-edge hardware and software can find a company upon which they rely taken over by another company or out of business entirely. The result can be a significant degradation or elimination of support.

Haves and have-nots – Targeted and substantial investments in technology leadership in one area of the college can create internal tensions if other areas do not feel well served. For example, technology leadership in the modern languages can create campus problems, if other areas, such as the humanities, do not have adequate support for basic operations such as Web browsing or electronic mail.

Automation and cultural change – A common risk of using information technologies to improve efficiency is that the focus will be on automation rather than redesign. That is, instead of analyzing administrative processes to make them simpler, more efficient, or more cost-effective, emphasis is placed on using technology merely to speed up existing procedures without considering their real usefulness.

Further, any effort to improve efficiency will result in cultural change. For example, using electronic mail and bulletin boards to enhance and simplify communication on campus requires participation by the entire community if full benefits are to be achieved. Some individuals will see this kind of change as undesirable, resulting in a less "personal" approach to providing educational services. Change is a disorienting process for many, and cultural change, especially at small institutions with long academic traditions, is particularly difficult. Managing that change carefully must be a primary consideration for institutions attempting to be technology leaders. If handled badly, such changes can result in a backlash that could seriously impede future technology innovations.

Marginal investments – Small colleges already have many of the characteristics of the ideal learning environment for students. In particular, these institutions provide small classes, opportunities for frequent and substantive interactions between faculty and students, opportunities for all students to be involved in co-curricular activities which complement classroom learning, and a variety of support services to assist student learning. These are among the most important reasons why students and their parents are attracted to these institutions. Applications of technology can provide opportunities to further enhance these characteristics. However, equating instructional excellence with information technology leadership is risky. The fundamental decision an institution must make is which areas of technology leadership are likely to improve the campus learning environment.

Some Final Thoughts

The competition for students among higher education institutions is fierce, and institutions have to balance their investments between technology and competing interests. Among these interests are: financial aid for attracting a diverse student body; improving salaries to attract the most gifted teachers, scholars, and support staff; creating an attractive social environment; and renovation or replacement of physical plant facilities to provide modern learning environments. While it is true that technology investments, at some level, are necessary to provide the tools necessary for students to be prepared for life beyond college, decisions about which college to attend are far more idiosyncratic than analytical. A focus on technology leadership beyond a certain point may not be as important as other investments. It is well known, for example, that the quality of a student tour guide, interactions with faculty while visiting a campus, the social climate on a campus, and the sense of whether the student "fits" at the institution play major roles in the student's selection of a college. While a certain level of institutional technological sophistication is expected, and perhaps even sought, it is not the ultimate determining factor.

Major investments in becoming a technology leader must therefore be weighed carefully against the backdrop of other institutional priorities. Not every small college can or should be a technology leader and those that strive for technology leadership should bear in mind that being a leader is best pursued by excelling in a particular area (or areas), not by attempting to conquer every possible technological frontier. In the end, however, small colleges must seek leadership from within their ranks if they are to help one another find solutions to technological problems.

Strategic Planning across Multiple Organizations: Community Colleges MIS Consortium and the Central Oregon University Center

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Abstract

Technology expands both the need for and the practice of collaboration across institutional boundaries. Strategic planning for key concepts--shared values, common vision, and future-directed strategic intents--are even more complete when multiple organizations plan together. The technological elements can be adressed at least partially with technology; however, the human and political factors most be carefully attended or the process goes nowhere.

In these papers, Dr. Brown lays out fundamental principles of strategic planning that apply to collaborative endeavors, Dr. Romero discusses the strategic planning issues and outcomes of the California Community College Management Information System Consortium, and Dr. Markwood describes the context, planning, and implementation of the emerging Central Oregon University Center, which delivers bachelor's, master's, and professional degree programs from other Oregon institutions.

1-2-2

Planning and Collaboration
Engaging Multiple Institutions in a Shared Vision
A Case Study

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Managing and leading a multiple institution collaborative requires greater flexibility in strategic planning efforts. Political realities as well as output goals must be kept constantly in balance in order to succeed. This case study describes a collaborative venture involving nine California Community College districts at the inception of the project. All original districts are still involved and one additional California district has joined the Consortium.
More recently, an Oregon Community College district joined the Consortium.

COMMUNITY COLLEGE MIS CONSORTIUM

INTRODUCTION

Unlike the University Center, the MIS Consortium has one shared vision upon which every district in the collaboration agrees: To develop an integrated MIS package for the member community colleges. Developed by users to meet user's needs, the software will run on the various platforms and systems of the member districts.

PLANNING AND COLLABORATION

Planning by the Consortium has been advanced by the common vision we share. District Chief Information Systems Officers have been our primary environmental scanners as they looked for hardware and software developments in the field, and as they evaluated potential commercial partners. Consortium Board sub-committees have also formed, as needed, to plan and redirect efforts. The Consortium has focused on mutual goals and negotiated agreement on process. I intend to focus on the political realities of multiple institution collaboration and the team learning which must occur if an initiative is to be successful.

Collaborative principles under which we function have included: discussion among co-equals at multiple levels of each institution and in the various consortium work groups, reaching consensus on development and implementation strategies--probably the most extensive of these has been the agreement reached regarding the functional requirements of the software (a copy of which is available for review for those of you who might be interested), and the respect which has evolved among colleagues working on the project. One major issue which required considerable conversation was the work style difference between contract employees and district loaned staff.

BALANCING POLITICAL DIFFERENCES

But the most challenging and important planning and collaboration factors have been the political needs and differences in culture of each district. Managing these differences in perception and in expressed needs at every level of the collaboration has become our most essential task. The willingness of each district to stay involved as well as the efficiency with which our products are generated is influenced by our response to political situations within the districts.

To put the process in Peter Senge's words, the need to map our mental model of the "how" requires team learning at a variety of levels.[1] For the Consortium, this has meant sifting through the input of many teams in addition to the obvious joint powers agency formed by the 10 districts. Each team operates within its own dynamics.

At the most fundamental level is the team of CEO and District Board. Over our four years in history, the CEO and Board of each district has struggled with issues of commitment and staying the course. None of us anticipated the length of time and the complexity to be addressed in meeting our goal.

For small districts the issues are often those surrounding commitment of significant resources when they do not benefit from economies of scale. The advantage is that by joining the Consortium they stand to gain from the collaborative efforts with large districts. For the large districts, the question has often been whether they could more easily (with less complexity) achieve the goal on their own given the large sums of money they are committing to the project. The advantage has been that in pooling their resources and developing a product with transportability, Consortium members might recover their investment by making their product available to different sized institutions operating with different hardware.

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[1] Peter M. Senge, The Fifth Discipline (New York: Doubleday, 1990) p. 188.6

One collaborative challenge has been identifying and responding to the needs of each district in order to keep the project afloat. Thus, at times we have shifted the priority regarding which modules should come out of development first in order to address a pressing need of one or two districts. At other times the Board has struggled to define the scope of work. At one time strong marketing and promotion of the anticipated product was seen as a way to ensure a return on our investment. Ultimately, the Board held a retreat and decided unanimously that our goal was first to develop a product which met the member district's needs and the product's marketable potential would be determined later.

Another challenge for the Board has been as arbitrator for the other work groups on the project. At the Chief Information Systems Officer level the mapping has involved reaching agreement about compatible platforms, analysis of different systems in use, and consensus about the most flexible yet serviceable platform on which to build the system. Each CISO obviously comes to the table with his or her own commitment to products and equipment which he or she helped select and having convinced others at his or her own district of the benefits of his or her selection. Now those decisions must be modified.

At the staff levels of the SCG and the Design Teams, other issues of personal commitment to existing processes, hardware, and software have had to be overcome. The resistance to changing dynamics is most active at this level.

Staff changes, especially at the CEO's level, have required a continual process of re-commitment to the concept and the agency. Of the original CEOs, only four remain.

TEAM LEARNING

Another major element of both strategic planning and collaboration involves team learning and the need to distinguish between dialogue and discussion. Our inclination in higher education, and in this project as well, has been to move directly into discussion with its deliberation of pros and cons of the action to be taken. What we have learned more slowly and more painfully has been the need to stop, step back, and engage in dialogue. Again, Peter Senge's model is instructive. As a key to team learning, Senge describes dialogue as a process where one suspends one's assumptions and participates in conversation as a colleague, where the process of thinking through everyone's assumptions and ideas is more important than taking a stand and defending it as one does in discussion[2]. For the Consortium Board, this has become an important part of our retreats. Senge's requirement that all participate as colleagues has not been problematic but with a roomful of action oriented, action generating, CEOs having to put our own needs and agenda aside to frame and redirect the larger picture has been a learning process. The success of our efforts is evident in our accomplishments to date. This team learning process is repeated in each district over and over again as different issues are raised at different levels of each institution and with different work groups.

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[2] Peter M. Senge, The Fifth Discipline (New York: Doubleday, 1990) pp. 238-243.

FLEXIBILITY

Finally, the need for flexibility cannot be overemphasized. Any major collaboration takes time and plans must be constantly re-assessed and modified to fit unanticipated complexities. Altering original plans, however, is difficult with multiple constituencies because each sub-set is also responding to its own constituency issues. Often we have yearned for the simpler process of being an independent software development business without the structures which frame our discussions and inhibit our dialogue. Ultimately, however, the Consortium is an example of an incredibly successful collaboration and of what is possible when the goal is common and the players' commitment to the goal allows them to make just-in-time changes to meet that goal.

The lessons we have learned include:

1. To be effective a collaborative planning effort must take into account the political agendas of all members.
2. The collaboration will only be successful if trust and flexibility exist and the project can make changes to accommodate the needs of a partner without losing sight of the common goal.
3. A forum must exist to resolve conflicts as they arise.
4. Periodic time must be set aside to evaluate progress, redirect efforts, ensure partners renew their commitment to the goal, and celebrate success.

Strategic planning principles can help but I would end by saying that collaborative ventures are not for the faint of heart.

Strategic Planning And Collaboration
A Case Study

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This brief paper attempts to make a few significant points about Strategic Planning and the process of Collaboration. It outlines a series of questions to be used in setting ground rules for collaboration as well as a set of landmines to avoid.

STRATEGIC PLANNING AND COLLABORATION

STRATEGIC PLANNING

This brief paper attempts to make a few significant points about Strategic Planning and the process of Collaboration. Strategic planning has been touted as one of the essential tools to assist organizations adapt to changed conditions. There is no doubt that strategic planning is a useful and a powerful tool for helping people tap into their dreams and values and move to a higher level of motivation and insight. The process, however, is not a "magic bullet" and the effectiveness of the process depends largely on the skills of individuals involved and the process which is designed and utilized.

1 Many believe the effort of strategic planning ends with the development of the vision, mission, strategic goals or other formats that are used. What is often overlooked is the need for the development of an implementation plan which translates the strategic plan to the reality of the operations and tasks that are essential for the attainment of the strategic plan.

2 Attainment of an implementation/strategic plan requires ongoing monitoring and attention. Many boards, executives and managers complete the plan and assume it will happen. Strategic planning requires new belief systems, new ways of thinking and new ways of behaving. Staff and policy groups must view policies, decisions and behaviors through the glasses provided by the directions of the strategic plan. Policies, decisions and behaviors must be made with reference to their ability to support the strategic directions.

3 Strategic planning must be an ongoing process. Not only should progress be monitored, problems identified and considered, but also re-evaluated in terms of the strategic directions in the original plan. When necessary, the plan should be adapted or modified in light of new information and levels of progress.

4 Strategic planning must be developed and implemented in an open spirit of participation and ownership. Too often, one or a few leaders push a plan without involving key persons and maintaining the understanding of the stakeholders in the organization. Collaboration is the result of shared beliefs, motivations and values. When these are not maintained, support and motivation for implementing the plan diminishes.

COLLABORATION

Cooperation, in which partners agree to work together to meet their individual goals without substantially changing the services they provide or the rules and regulations governing their institutions, is not enough. Collaboration partners share a vision, establish common goals, and agree to use their power to achieve them, commit resources and willingly alter existing policies to meet the common goal.

5 **Establishing Shared Leadership**

A collaborative is most effective when all partners exercise leadership. Partners work as equals rather than dominating those they perceive as less powerful.

6 **Setting Ground Rules**

Successful collaboration requires that everyone in the group contributes to and develops a stake in the process. Ground rules can ensure that partners use time wisely, share leadership, and head in the same direction. These rules should cover maintaining communication among partners, operating the collaborative on a day-to-day basis, resolving organizational and personal conflict issues, and planning and conducting meetings. Collaboratives need to decide:

1. Where, when, and how often will partners meet?
2. How will partners share responsibility for organizing and leading the meetings?
3. Who prepares and contributes to the agenda?
4. What rules should guide the dialogue?
5. Will partners make decisions by majority rule or consensus?
6. What can partners do to ensure that decisionmaking occurs inside the group and not behind the scenes?
7. What happens if there is a problem or conflict?
8. How will partners handle logistical arrangements?
9. Under what circumstances should there be a third-party facilitator?

7 Landmines to Avoid

1. Waiting to convene a group until everyone is at the table. The enthusiasm of a wisely selected and enthusiastic core group can cool while others are being brought in. Do not waste time!
2. Not taking the time to involve key players who could easily block what the collaborative hopes to do. Whenever possible, try to make allies out of adversaries.
3. Allowing one partner to assume control of the group instead of establishing the expectation of shared leadership. Collaborative power grows when equals share authority and responsibility.
4. Allowing the media or political pressure to direct the collaborative's agenda.
5. Neglecting to reflect periodically on milestones and landmines.
6. Failing to establish clear ground rules.

8 Developing a Base of Common Knowledge

In the most effective collaboratives, partners take time to understand each other's systems and explore their differences. Partners with limited knowledge of each other's organizations often rely on stereotypes and misconceptions to fill in the blanks. To avoid misunderstanding, partners must develop a base of common knowledge. This requires learning about each other's services and resources, goals, objectives, organizational cultures, and working constraints. Developing common knowledge also means understanding personal differences and working together to achieve small victories.

9 Deepening the Collaborative Culture

To realize the vision of change, the cultures of all the institutions and agencies in the collaborative change. Collaboration becomes a fundamental part of each agency's mission and approach. Leaders committed to collaboration find ways to reward staff who devote time and energy to the collaborative.

1-2-10

Strategic Planning in Multiple Institution Settings
A Case Study

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Collaborations may involve organizations with conflicting long-range agendas and still succeed. Even though the collaborating organizations are headed toward different ultimate goals, there may be sufficient common ground and interest to support a collaborative program that will advance both agendas despite the conflict in ultimate goals. These generalizations about strategic planning arise from my experience as Dean and Director of the Central Oregon University Center. This analysis is presented as a case study of one multiple-organization project and is intended to illustrate a practical approach to strategic planning in multiple institution settings.

Strategic Planning in Multiple Institution Settings: A Case Study
Richard A. Markwood

Introduction

Collaborations may involve organizations with conflicting long-range agendas and still succeed. Even though the collaborating organizations are headed toward different ultimate goals, there may be sufficient common ground and interest to support a collaborative program that will advance both agendas despite the conflict in ultimate goals. These generalizations about strategic planning arise from my experience as Dean and Director of the Central Oregon University Center. This analysis is presented as a case study of one multiple-organization project and is intended to illustrate a practical approach to strategic planning in multiple institution settings.

The Central Oregon University Center

The Central Oregon University Center (University Center) is a partnership which involves (1) the Oregon State System of Higher Education (OSSHE), (2) the Oregon Office of Community College Services (OCCS), and (3) Central Oregon Community College (COCC). The mission of the University Center is to deliver baccalaureate, master's, and professional degree programs to Central Oregon. Those not familiar with geography and climate of the Northwest should know that the rain typical of the coastal Northwest is cooled, converted to snow, and deposited on the Cascades by the east-bound storm systems. This creates the powder skiing on Mount Bachelor (twenty minutes from Bend) widely acknowledged the best in the Northwest gives us a dry and sunny climate east of the Cascades very much like the mountains of Colorado and New Mexico. These same weather patterns, however, also create treacherous and difficult winter driving for travelers heading from Central Oregon to the Willamette Valley where are Eugene, Corvallis, and Portland, Oregon's population centers and the centers of the majority of Oregon's public and private education resources. Two factors create the need for four-year higher education programs in Central Oregon: a rapidly growing population and isolation caused by distance and weather.

The University Center is designed to serve this need by using (1) the facilities of COCC, (2) the technological capacity of Oregon ED-NET, and (3) the educational resources of all of Oregon's institutions of higher education. The University Center motto is "Education by All Means": it employs traveling faculty, community college faculty, adjunct faculty, two-way compressed video and audio, one-way video/two-way audio, computer-based delivery, video taped classes, and multiple combinations of the above.

This mission-oriented description of the University Center, however, neglects a very important political history which comes into play in the strategic planning. Since 1977, perhaps earlier, Central Oregon Community College and its larger community have worked to create a four-year college in Bend. The first four-year degree program opened in 1981, a BA in Business from Linfield College. The next year, 1982, Oregon State University began delivering, and continues to deliver, four-year programs to Central Oregon. Between 1983 and 1986, a committee of prominent citizens in Bend calling themselves the "Education Committee" actively planned for and lobbied the Oregon Legislature and the higher education community for a four-year institution in Bend (1985). These efforts led to the formation of a the Central Oregon Consortium for Higher Education (COCHE) which earned the support of the Fund for the Improvement of Postsecondary Education (FIPSE) between 1989 and 1991. Participating institutions increased. However, COCHE died after the FIPSE money ran out. The University Center is the newest incarnation of this ongoing effort. It was funded in a budget footnote in the Higher Education funding bill of the 1994/95 Biennium by influential Central Oregon legislators expressing their vision they have for higher education in the area. Throughout this fifteen to twenty year history and today, Central Oregon has never wavered in its ambition to become a four-year institution.

Oregon State System of Higher Education

However, in the State Capital and in the Willamette Valley the view is different. Even though the "Education Committee" was successful in getting the endorsement of every public four year institution in the state and of two private four-year institutions, the campaign for four-year status was unsuccessful because the Chancellor of the State System, then Bud Davis, opposed it. From his perspective and that of the Board of Higher Education, there could be little hope of funding more institutions when resources were declining and the Oregon tax payers were revolting. A short time after the "Education Committee" lost in this effort, Ballot Measure 5 (November 1990) re-wrote higher education history in Oregon. Measure 5 won voter support because it promised to control and reduce property taxes. But few citizens foresaw the effects of Measure 5 on many state agencies. These effects spread over three funding cycles (six years) have resulted in OSSHE and other state agencies receiving greatly reduced appropriations in each funding cycle. OSSHE as a system has become leaner; institutions have learned to deal with non-formula-based funding; faculty have gone without pay increases; close to 100 programs have been cut; and tuitions have more than doubled. It is no surprise that in this environment there has been little support for creating another four-year institution in Central Oregon.

Strategic Planning

OSSHE has responded to these extended budget crises by reinventing itself in many ways. Crises frequently force planning, and planning frequently produces renewal. This has been true in Oregon. The planning product is "Education Unbounded: A Vision of Public Higher Education Serving Oregon in the Year 2010." Although OSSHE did not create the partnership which forms the University Center, and has no enthusiasm for creating another four-year institution, it can nevertheless find within its "Vision of 2010" rationale for supporting the University Center.

From their perspective, the COCC President and Board see the University Center as the means to move COCC toward their long-term goal. They believe the goal can be achieved. In a draft "Vision Concept Paper," they say, "The long-term future for COCC is unlimited and is constrained only by the combined imagination of the Board of Directors and the leadership staff of the College." They list a number of specific statements which are local initiatives consonant with many of the OSSHE 2010 goals. Key phrases in the COCC vision are taken directly from the OSSHE 2010 statement. By employing this common language COCC assures a resonance with OSSHE that demonstrates the visions are synchronous. The potential for conflict in directions--OSSHE on the one hand looking for programmatic alternatives to building new buildings and new campuses, COCC on the other hand not wavering from its long term goal of becoming a four year institution--meet in a vision which maps a common program.

As Director of the University Center, I ask, "Can such a partnership work, or must it be hopelessly politicized?" It can work. The "Vision of 2010" advances several important and relevant agendas: (1) New partnerships--Build collaborations and realize efficiencies resulting from collaboration; (2) Turf-- Systemwide resources will be focused on local, regional and state needs; (3) Seamlessness--Clients will more easily tread the path through the educational systems kindergarten through higher education; (4) Technologies--Institutions and students must have increased access to technologies, and (6) Information--Information access will be made easier.

The University Center addresses these goals as follows:

Collaborations--The University Center provides a setting for innovation. For example the COCC English faculty have been approved by Eastern Oregon State College English

Department to deliver all upper-level English courses of the minor for the BA in Multidisciplinary Studies. Secondly, we are working to develop a collaborative Environmental Technology degree program and anticipate that at least one class will meet simultaneously on three campuses (four-year and community) and be taught by a team of three teachers representing each of the three campuses.

Turf--Currently two private colleges, three OSSHE institutions, and the newly independent public Oregon Health Sciences University deliver programs to the University Center. The number of institutions will grow; each new program changes the turf map.

Seamlessness--In the Eastern Oregon State College Multidisciplinary Studies Program, a student can complete an COCC AA degree in two years, complete an Eastern BA degree in four years, and earn a basic license to teach elementary education granted by the Oregon Teacher Standards and Practices Commission (TSPC), all of this at a cost lower than the student would have paid had he/she spent four years at Eastern.

Technologies--The University Center relies on technologies and helps students develop increasing competency in the use of technologies.

Information--University Center is working with two major library collaborative initiatives to support University Center students, Portals (Portland group of libraries who cooperatively purchase data-base access) and ORBIS (a union catalog based on Innovative Interfaces Inc.'s software).

The University Center in its second year this fall enrolled 80.4 FTEs, 392 individual class enrollments and 160 students known to be seeking degrees. These enrollments will increase and each enrollment will help build the case for a four-year institution in Central Oregon. These programmatic activities, strategically define a broad middle ground between competing agendas, serve the visions of both OSSHE and COCC, and thereby advance the agendas of both.

1-2-14

COMMUNITY COLLEGE MIS CONSORTIUM
(CCMISC)

ORGANIZATION:

1 Originally Nine Districts/14 colleges
2 Now 10 Districts/15 colleges in California and one district in Oregon:
3 Member districts include:

DISTRICT	ENROLLMENT
Butte Community College District	11,839
Citrus Community College District	10,000
Coast Community College District	57,653
Glendale Community College District	20,232
Los Rios Community College District	50,484
Marin Community College District	10,303
Palomar Community College District	22,845
Sierra Joint Community College District	14,500*
Siskiyou Joint Community College District	3,013
Yosemite Community College District	19,232
Central Oregon Community College	2,500*
*New Member 1995	

FUNCTIONAL STRUCTURE:

4 **Joint Powers Agency**
Separate entity from the districts. Established June 13, 1991.

5 **Board of Directors**
Made up of CEOs from each district.

6 **Chief Information Systems Officers Advisory Committee (CISOAC)**
This committee is comprised of the Chief Information Systems Officer from each Member District. They are advisory to the Board and to the Executive Director. The Chair also sits on the Board as an ex officio member. This committee's role is to see that the software being developed meets each district's needs and will function properly in each environment. The Chair of the Steering Committee sits as an ex officio member.

7 **System Coordinating Group (SCG)**
There are four SCGs, one for each area of the system development: Student Services, Administrative Services, Instructional Management and Human Resources. Each group is composed of a second level administrator from the respective area from each District, i.e., a Dean or Vice President. The primary role of these committees is establishing the overall

functionality or capability of the system. They also play major roles in oversight and coordination of Design Team activities and linkages between the various areas.

8 **Design Team**

There are numerous design teams under each SCG. For example, Student Services includes design teams for Admissions, Registration, Matriculation, Grades and Attendance, etc. Each design team is comprised of district staff who are users and area experts. The team of 6-10 are assisted by two Information Systems Analysts who serve as staff to the Consortium. Their role is to refine the system functionality and design the processes.

9 **Steering Committee**

The primary role of the Steering Committee is to oversee and coordinate activities of the SCGs and to represent users interests, if necessary, to the Board. This committee is comprised of the Chairs of the four SCGs, the Chair of the CISOAC, and the Executive Director.

10 **Consortium Staff**

Consortium staff are all the people who are assigned to the project full-time. This includes district staff and contractors. The current complement is 40 people.

11 **Goal**

To design and develop a comprehensive, totally integrated community college management information system which has the following system characteristics:

1open system
2utilizes relational data bases
3client server
4easy to maintain
5graphical user interface (Windows)
6integrated system
7flexible - off the shelf with capacity to customize
8designed by users
9meets industry standards

SCOPE OF THE PROJECT:

There are 4 major integrated systems:

Administrative/Financial

(11 modules)

Payroll
Purchasing
Receiving
Facilities Management
Fixed Assets
Auxiliary Fund Accounting
Employee Benefits
Accounts Payable
Budget & General Ledger
Warehouse
Accounts Receivables & Fees

Human Resources

(5 modules)

Applicant Management
Employee Records
Position Control
Employee Utilization
Compensation

Instructional Management

(2 modules)

Course & Curriculum/Curriculum Assessment
Scheduling

Student Services

(7 modules)

Admissions
Matriculation
Registration
Attendance & Grades
Academic History
Student Services Scheduling
Categorical Programs

FUNDING BASE:

12 **District Assessment**

Each district is assessed, annually, proportional fees based on the Consortium formula.

The formula includes a fixed amount for administration from each District plus a per head count assessment of the base year enrollment.

13 **District Fair Share**

District Fair Share allocation is an allocation-for staffing the project with Information Systems staff. A District's fair share is determined by taking the number of staff needed; at the present time that number is 21; and multiplying it by the percentage of Annual Assessment that a District provides, i.e., if a District's assessment was 20% of the total, their fair share of staffing would be 4 FTE. Therefore, in addition to the Annual Assessment, a district is also responsible for paying the appropriate amount for the number FTE they owe. A District may lend their own district information systems staff in lieu of payment if the staff have the skills needed by the project.

TIMEFRAME FOR DELIVERY:

The first module of the software (Applicant Management) is scheduled for delivery November, 1995. Thereafter, software modules will begin to be delivered every 2-3 months. Version 1 of the entire system is scheduled for completion by the end of Fiscal Year 1997-98.

Each module will be pilot tested by selected member districts prior to release to the other districts.

Delivery is scheduled first to member districts but the possibility of making the system available to other districts is being investigated now.

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IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Multi-faceted Planning in "REAL" IT

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Developing and communicating visionary and practical strategies for information technology efforts is at once inspiring and onerous. In our too-REAL world, the dynamic impacts of rapid technology movement, exponentially growing client expectations, increasing demand on resources, and sheer momentum of change seem to defy the usual concepts involved in planning. Yet we must find ways to chart our courses, meet the ongoing needs of our institutions, lead in overall IT directions, and articulate these efforts.

This paper presents a multi-faceted set of planning ideas, philosophies, and implementations. The ADP Center at Iowa State University uses these to help serve clients in a continuing quality manner. The paper includes an overview of planning objectives, strategic directions, goals for the year 2000, client expectations, organization methods, and implementation priorities.

The on-going plans focus on mission-critical information systems and client service support. Administrative tools are presented to show the practicality of this "Multi-faceted Planning in REAL IT" at ISU.

Multi-faceted Planning in "REAL" IT

Planning for information technology programs and activities in organizations can be conceptualized in many different abstractions, processes and implementations. If one would ask a random group of people about what planning for IT means, what it should include and how it should happen, surely, the answers would cover a broad range of concepts, focuses, and details. Their responses would reflect the general paradigms of the respondent's view of IT. Many professionals find it hard to plan in the dynamic IT environment. Some information technology professionals feel it may be impossible to plan for the future in IT. There have been recent indications that some CEOs of large IT corporations feel that long-term planing is too formal for IT activities. They suggest that planning can be a hindrance and thus they look at driving out long-term planning to actually make their business more change oriented and successful.

Suggestions that planning may not work in IT presents quite a paradox. Without a plan or focus, our organizations may be going in many directions which can cause a lower success level or actual failure. All organizations and individuals are going somewhere, it is a matter of being a planned or random direction. If it is not driven by planning, then the road may be a lot tougher, valuable resources may be wasted, and effectiveness and efficiencies may be much lower than could be the case with good planning.

Strategic planning is an active rather than passive activity...

The benefits of strategic planning include a systematic approach for guiding an organization over time through known and unknown changes in its environment with the goal of achieving desired outcomes. This approach confronts major strategic decisions facing an organization. It involves developing a desired future and identifying ways to bring it about through broad principles and concepts. Strategic planning attempts to take advantage of the new and different opportunities of tomorrow while reducing any negative consequences of the unexpected challenges. Strategic planning should be an active rather than passive activity in the approach to continually monitoring an organization's current assessment to keep the organization focused and in line with the changing environment.

Some confuse strategic planning with making future decisions. One can only make decisions for today, but can try to predict the future and develop plans based on present-day factors. This is why plans need to be flexible to allow for the changes over time. With an underlying understanding of where an organization wants to go, a plan will be easier to modify as factors change over time.

Communicate Directions

A key objective of planning is to communicate to staff and clients the directions and actions for reaching the organization's goals. It is important that the plan be more than a document that sits on a shelf. It should be an active instrument used to define organizational directions as well as to communicate the directions to staff, clients and constituents. Meeting client expectations and providing quality services in all activities is of primary consideration.

A major problem in many organizations is a lack of clear definition of the major functions and goals. This leads to the view that the organization does not know what it is doing and to varying concepts about what they are and should be doing all based on the constituent's viewpoint and knowledge. Well defined and organized planning documents can do much to alleviate these short comings.

From the time of development through implementation, it is important that the staff feel they have a part in the plan and understand its meaning. This will help staff feel committed to the strategic plan and refer to it in daily activities. The strategic plan should also provide a direction for staff members. In all of their planning activities, annual or daily, the staff can use the plan as a guide to sort out relevant activities.

A strategic plan is also important in working with clients and constituents for communicating the defined priorities and goals. This is aimed at showing that an organization is in control of its efforts and directions to help the constituents feel comfortable about their investment and about the services they receive from the university and the ADP Center.

This principle of communication is inherent in communicating vision, goals and directions to various entities. At ISU, the university, Business & Finance, and ADP Center five year plans were developed by communicating commonality in language, directions, goals, and strategies.

While commonality is important, a single concept of planning or a single plan will not answer varying views. Thus, the ADP Center at Iowa State University has a multi-faceted approach to developing plans and to using tools for monitoring the status of plans. Multi-faceted planning involves planning on various levels, timeframes and situations. This is different than a one-time, static document. Figure 1 shows the three levels of planning at

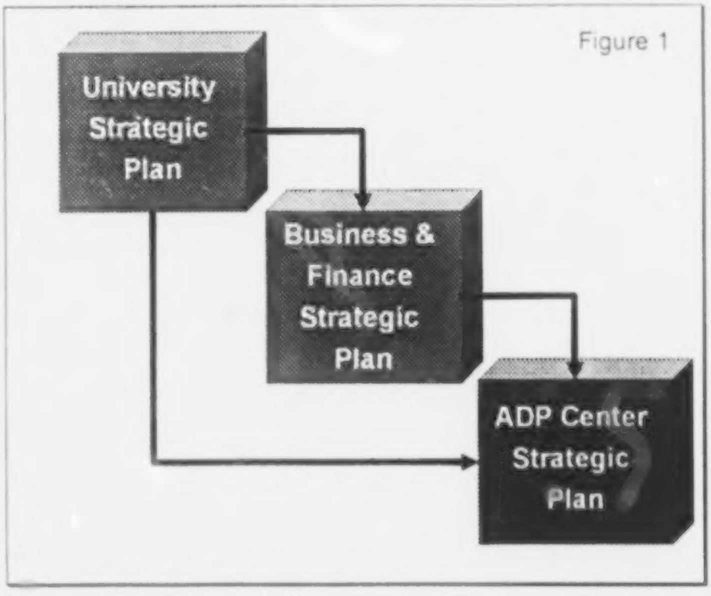


Figure 1
University Strategic Plan
Business & Finance Strategic Plan
ADP Center Strategic Plan

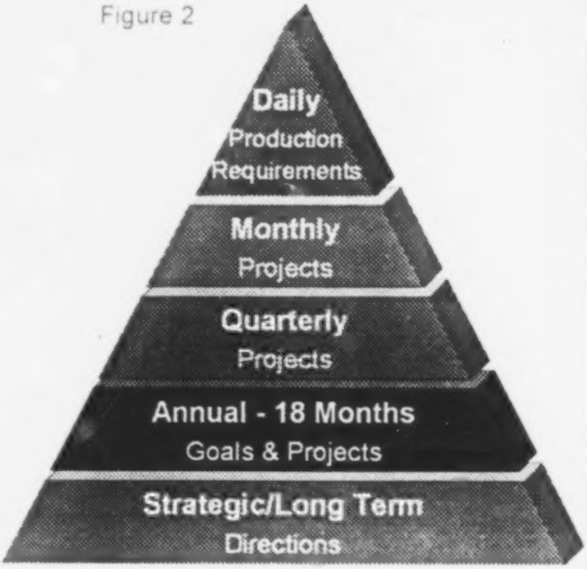
Iowa State University, while figure 2 shows the planning levels in the ADP Center as well as the different timeframes used.

Dynamic activities require on-going interactive use of the planning tools to assure that the intended impact of planning is attained. In this sense, planning has its own life. Planning needs to be dynamic to reflect the various changes in an organization and its environment. As a plan matures, it needs to be flexible to adapt to changes in the environment. If planning is thought of as a one-time document development that cannot change, the plans will not be useful to an organization because the plans will not grow with the organization.

Planning Tools and Levels

Recognizing the importance of multi-faceted planning, Figure 2 represents the different planning levels and planning timeframes used in the ISU ADP Center. This model also represents the notion that strategic goals are broad and each level beyond that expresses more specific goals. Each of these is further explained.

Figure 2



Strategic/Long Term

Strategic/Long term planning provides a foundation for the direction of where the Center wants to go. This is important in the rapidly changing environment of IT. A **broad set of goals** provides the spectrum for new technologies that may be developed or any changes in the environment.

Annual to 18 Months

This time frame provides direction for goals and **projects** that need to be implemented in order to reach the strategic goals. These are generally more defined by budgets, and other resources available.

Quarterly

Quarterly planning provides a timeframe that is easier to grasp on a large project. This also provides a guideline for how a particular project is progressing. An important aspect in completing a project is to break it down into doable pieces or tasks. Through quarterly planning, annual goals can be broken into doable **tasks**.

Monthly

Monthly meetings and interactions are used to monitor progress and other **details** on projects. This gives the opportunity to make changes to meet unexpected needs during the quarter.

Daily

Each day presents a specific set of tasks and a new set of plans for the day. These are primarily **production** requirements and answer the basic question, "What do I need to accomplish today and how will I accomplish it?" Properly done, this is much like strategic planning in that it sorts out the important tasks that need to be done in order to reach the goals. Daily goals help attain quarterly goals, quarterly goals help attain annual goals, and annual goals help attain strategic goals.

The remainder of the paper focuses on the development of the current ADP Center Strategic Plan as well as implementation of the plan and multi-faceted tools to monitor the Center's progress toward its strategic goals.

Developing the Current ADP Center Strategic Plan

Setting the Stage

A strategic planning group was formed within the ADP Center with the charge of developing a comprehensive ADP Center long-term plan. This group consisted of nine individuals from different areas across the Center. During the first meeting, the group discussed many issues that would help set the stage for future group discussions, activities and decisions. The group took time to discuss the topic of strategic planning. This discussion included what strategic planning is, what the purpose of strategic planning is, why do strategic planning, how will this plan be used, and how will this affect me.

The group discussed their individual roles in developing this plan. Because each person represented an area, they were to act as the representative for that particular area. This meant that individuals were to obtain constant feedback from their team. Another part of role definition was determining the parts of strategic planning for which the group was responsible. It was determined that the group would develop the plan and the ADP Center Administrative Group would be responsible for implementing the plan.

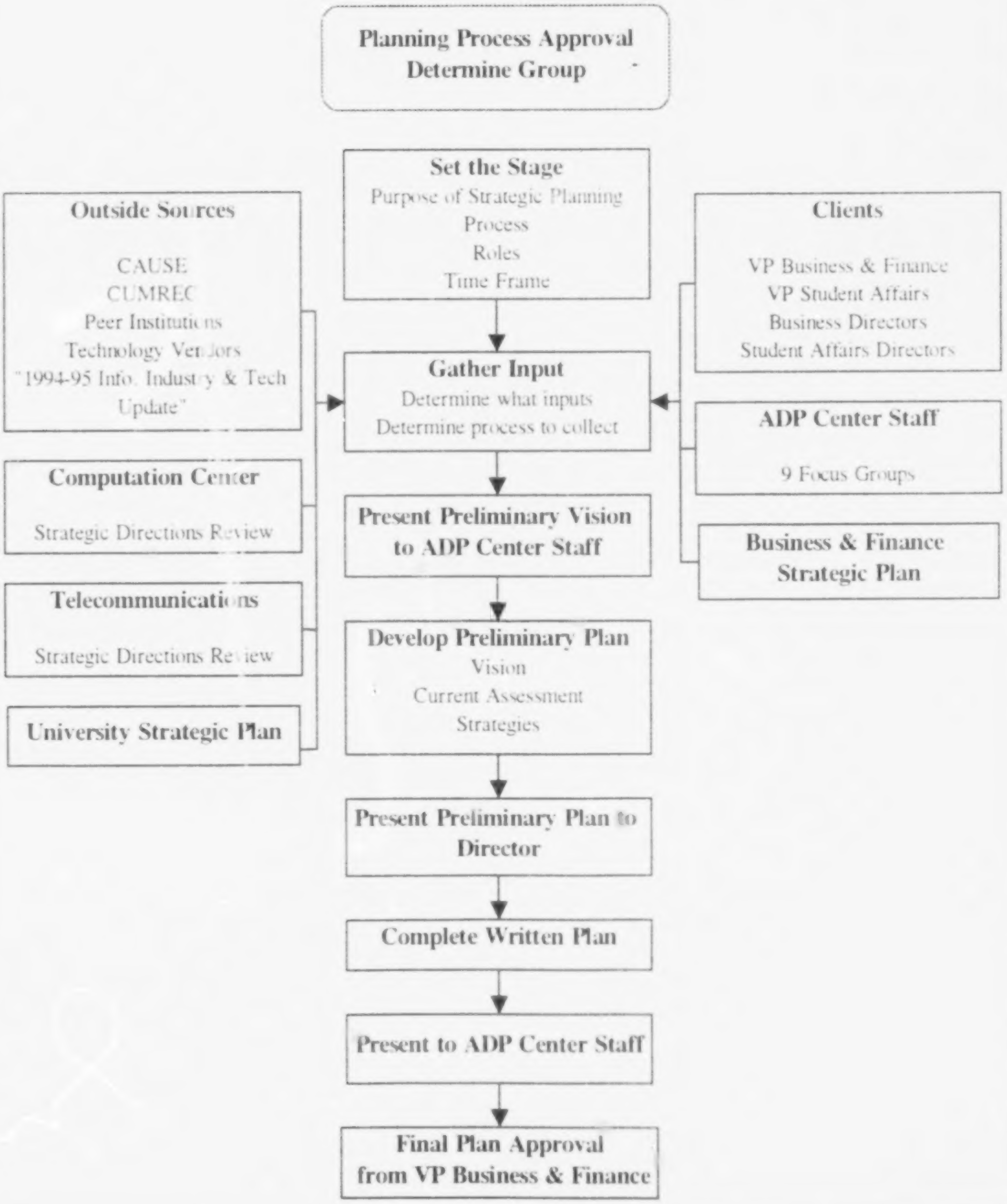
A process was developed to chart the steps involved in developing the plan. This process helped the group stay on track by knowing what needed to be done and the order of the activities. The process, as shown in figure 3, consists of gathering inputs, developing a vision, current assessment, and strategies, and writing a final report.

Another critical issue that needed to be decided was the timeframe for which we were planning. Since the information technology industry is constantly changing at an increasing rate, the group had to determine a reasonable timeframe to project. The group felt a ten year timeframe was too long and would be very hard to project. One to two years would be easier to predict, but the group felt that this planning was more like project planning and not planning for the future. Therefore, five years seemed like an appropriate timeframe to project.

1-3-6

Figure 3

Administrative Data Processing Center
Administrative Information Systems Technology Planning Process


Planning Process Approval
Determine Group
Set the Stage
Purpose of Strategic Planning Process
Roles
Time Frame
Outside Sources
CAUSE
CUMREC
Peer Institutions
Technology Vendors
"1994-95 Info. Industry & Tech Update"
Clients
VP Business & Finance
VP Student Affairs
Business Directors
Student Affairs Directors
Gather Input
Determine what inputs
Determine process to collect
ADP Center Staff
9 Focus Groups
Computation Center
Strategic Directions Review
Present Preliminary Vision to ADP Center Staff
Business & Finance Strategic Plan
Telecommunications
Strategic Directions Review
Develop Preliminary Plan
Vision
Current Assessment
Strategies
University Strategic Plan
Present Preliminary Plan to Director
Complete Written Plan
Present to ADP Center Staff
Final Plan Approval from VP Business & Finance

Inputs

The strategic planning group discussed the importance of obtaining inputs. Obtaining inputs from various sources would involve more people. This involvement can create an interest in the future of the Center as well as create buy-in and commitment to the final plan. It was decided that we should get as much input as practically feasible.

The group then discussed potential inputs for the planning process. The group brainstormed a list of areas to collect information and processes for collecting the information. The group decided to get input from the ADP Center staff, but thought it would be valuable to give the staff some background before asking them for input. "Discovering the Future: The Business of Paradigms," video was shown in several staff seminars in order to help the staff think about breakthrough visioning ideas for the year 2000.

The strategic planning group held nine focus group meetings wherein staff were asked for input on two questions:

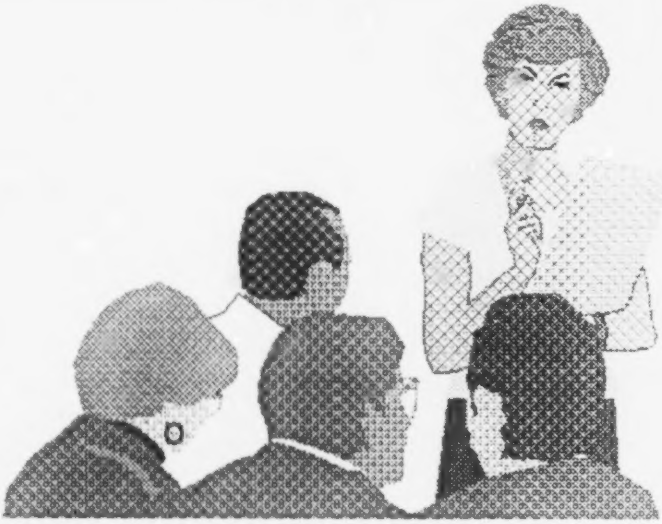
"Where do we (as an ADP Center) want to be in the year 2000?"

"What is the current assessment of the ADP Center?"

The SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis was used to analyze our current assessment. Strengths and Weaknesses examine internal factors such as structure, culture, and resources (people, dollars, space, technology, tools). Opportunities and Threats examine external factors such as economic, demographic, political-legal, social, and technology.

Additional focus groups were conducted with the university Business & Finance Directors and the Student Affairs Directors. Similar input was also obtained from the Vice Presidents for Business & Finance and Student Affairs.

Since the ADP Center works closely with other technology providers on campus, the group obtained inputs from the Computation Center and Telecommunications Department regarding their strategic directions.



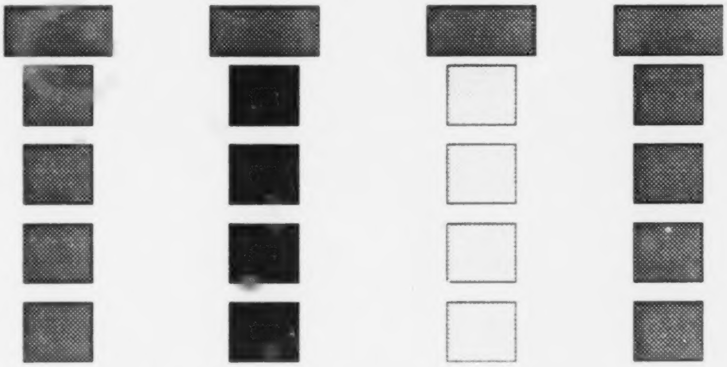
The group also obtained valuable inputs from various outside sources, such as publications from CAUSE and CUMREC that focused on where other institutions are heading. Various articles from vendors and other information technology publications were passed among the group members to make notes of important issues for the group to consider in developing the Center's plan. Another publication that was helpful to the group was the "1994-95 Information Industry and Technology Update," published by IDC. This publication predicted future directions in different areas of information technology, such as systems software, office information, client/server, etc.

The ADP Center developed its strategic plan concurrent with the development of the university strategic plan and the Business & Finance strategic plan. These emerging plans were also used as inputs to the ADP Center strategic plan.

Sorting

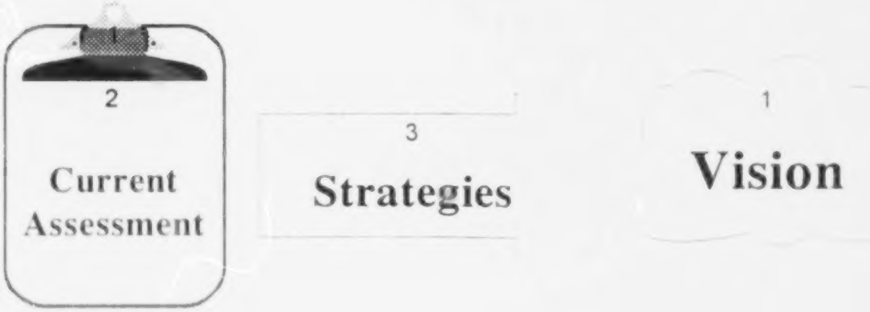
Next, came the task of trying to sort all of the inputs into meaningful information. This was a large task considering the group collected 264 vision responses and 220 SWOT responses from the staff focus groups alone.

The group used an affinity diagram to sort like ideas into categories. Using this tool, a group distributes all the ideas on a table. The group can also use Post-It™Notes and place the ideas on a wall. Next, the group members silently sort the ideas into categories with similar ideas. Once the process has stopped, the group discusses the categories and develops header cards for each category, representing the central idea in each category.



Plan Development

To develop the Center's Strategic Plan, the group used the process shown in the diagram below. This process included developing a vision, a current assessment, and finally, a set of strategies. These steps are explained below.



Vision

The affinity diagramming process led the ADP Center Strategic Planning Group to five major goals. The group developed the vision by describing the goals envisioned for the year 2000. The vision was developed first in order to avoid any tunnel vision that may occur from current views and habits. This vision was then presented to the staff to provide them with a summary of the inputs as well as to provide initial direction for the plan.

Current Assessment

Next, the group assessed the Center's current position, internally (strengths and weaknesses) and externally (opportunities and threats). Once again, the group used the affinity diagramming tool to sort responses in each SWOT area. From the categories and header cards, the group analyzed the results and prepared a current assessment summary.

Strategies

Strategies were developed to show the Center's actions needed for getting from where it is today (current assessment) to where it wants to be in the year 2000 (vision). Strategies were developed to link the current position to a goal or vision in the year 2000. The importance of this step is to verify that a particular goal is important and to commit a strategy to reaching that goal. Many times if a plan of action is not developed to complete a goal or task, it will not get done.

Strategic Goals

The following describe the five ADP Center Strategic Plan goals for moving toward the year 2000.

Goal 1: Enhance University-wide Administrative Information Systems and Client-support Services

Much of what the ADP Center envisions itself accomplishing in the next five years will be built on its established foundation of quality mission-critical business systems, reliable client-server networks, service to clients, high standards, and rapid response time. This foundation has enabled the ADP Center to position itself for change. By using technological advances, multi-platform delivery systems, team building, and reengineering concepts, the ADP Center will use its past as a springboard to propel itself into the next arena of information management.

Goal 2: Lead in the Development of Effective Partnerships

While the ADP Center must work with its clients in determining its focus of things it can do well within the resources available, the Center recognizes its responsibilities to a wide range of clients and understands the importance of addressing their needs and concerns. To maintain its effectiveness, the ADP Center must continue to emphasize partnerships between the ADP Center, its clients, and its vendors. Where beneficial partnerships can exist, the Center will need to help build them. Additionally, the Center will need to foster a spirit of cooperation that allows for a high degree of integration and connectivity with other campus agencies that provide IT support. Within this spirit of cooperation, the Center must help reach a consensus about shared duties, spheres of activity, and responsibilities. The

ADP Center will need to be a co-leader with its partners in reengineering the university's business processes

Goal 3: Expand and Enhance Information Access
One of the most important goals for the ADP Center will be to build on its established systems and networks to provide integrated access to university information through a coordinated network environment in which the university can conduct its business The Center will need to work to make technological solutions more user friendly

Goal 4: Foster Continued Development of a Quality, Highly Productive Staff
A critical element in the ADP Center's vision is its concept of what its staff will need to be in the coming years The ADP Center must encourage the highest aspirations and professional development in its staff members It must challenge them to seek new knowledge and encourage them to understand new technology and then apply their knowledge in practical situations for the ADP Center's clients

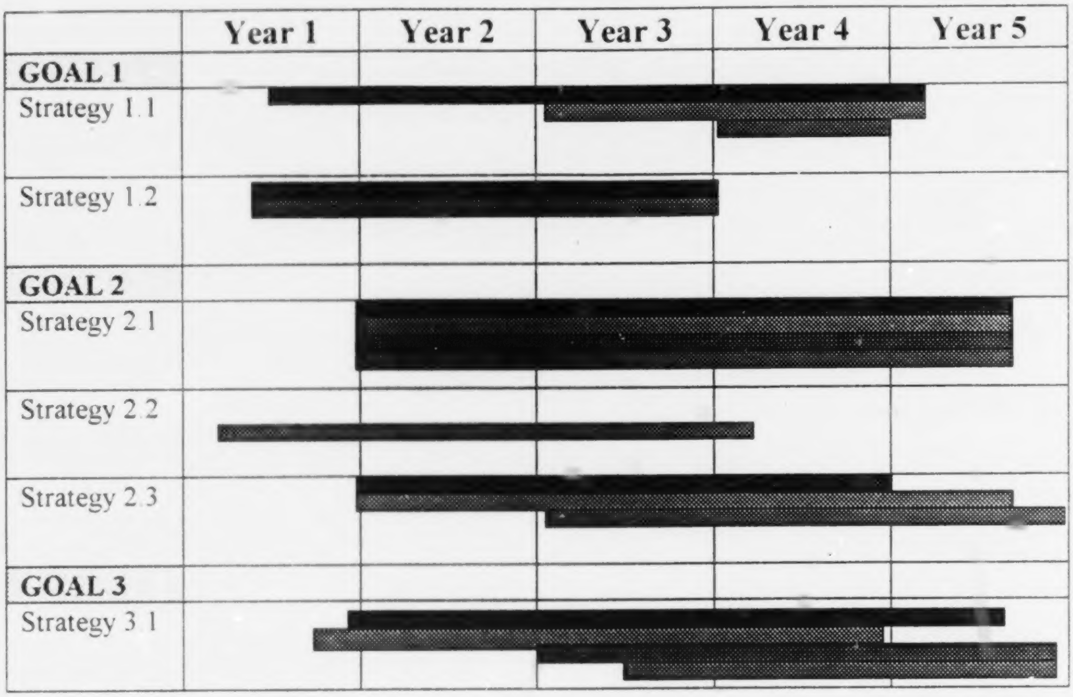
Goal 5: Promote the Development of Technological Tools and Capabilities
Iowa State University is a community that values the ability to translate knowledge into action and prizes a willingness to work with experimental technologies, sometimes even before their potential to become part of the mainstream has been recognized As an integral part of a university community in which technological advances are occurring at an ever increasing rate, the ADP Center must take a leadership role in blending new technologies into the university's administrative information systems The Center must be poised to take advantage of these advances and to incorporate them into its development and application platforms

Implementing the Plan

Planning for and following up on implementing the plan is also very important Various methods were used to inform the staff about the plan and to start the implementation

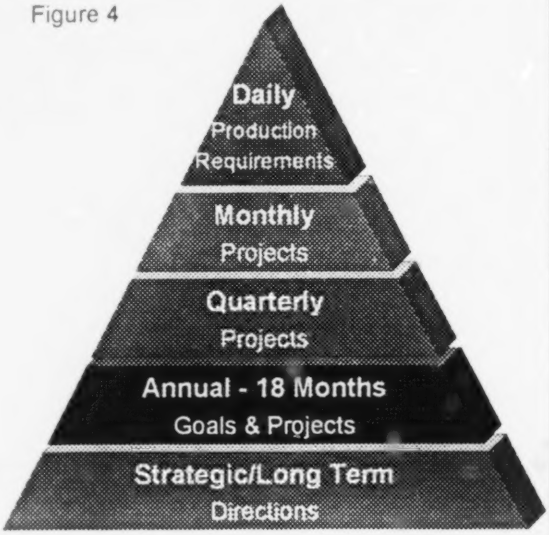
A staff seminar was held to review the purpose of strategic planning, and the process used A considerable amount of time was spent on communicating the vision and goals for the Center Examples were given so each team could see how the team fits into the strategic plan

To implement the strategic plan, the Administrative group developed a matrix, as shown on the following page, to help teams focus on goals and strategies relevant to them, to verify all strategies had ownership, and to consider any timeframe sequences Each bar represents an activity for which a team has participation



Planning Tools and Levels
Figure 4 shows the different planning levels and tools used in the ISU ADP Center. As defined earlier, these tools are used to assist in the implementation and monitoring of the strategic plan

Figure 4


Daily
Production Requirements
Monthly
Projects
Quarterly
Projects
Annual - 18 Months
Goals & Projects
Strategic/Long Term
Directions

Conclusion

Planning in a dynamic IT environment can seem like an enormous challenge. By using a well-defined strategic plan as a foundation and multi-faceted planning tools to support strategic activities, an organization can be better prepared for future changes in the IT environment. This should give more assurance that future goals will be met.

OLAP/EIS Tops Off the Data Warehouse

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ABSTRACT

On-Line Analytical Processing (OLAP) has emerged as a "break through" technology that can provide the foundation for fast, easy, affordable EIS solutions. OLAP technologies, when integrated with a data warehouse, can aggregate vast amounts of legacy data in both graphic and tabular formats. OLAP technologies feature very fast response, drag-and-drop navigation, point-and-click drill-down/drill-up among levels of detail, and value-based color highlighting for "exception reporting". Using OLAP/EIS solutions, senior managers are able to interactively "browse" hundreds of displays that present a visualization of their institution's business process.

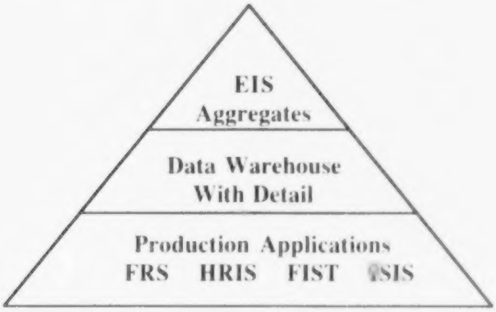
This presentation begins with a quick overview of the University of Rochester's approach to data administration including the development of a multi-gigabyte data warehouse. Distinctions between data querying, reporting, and analysis will be presented. OLAP will be featured as the newest form of these information services. Detailed information and a demonstration will highlight this session.

Information Technology Architecture: An Overview

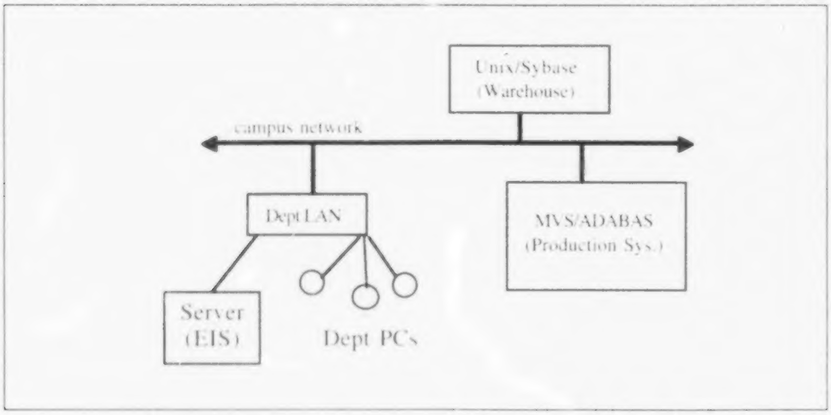
In the Spring of 1991 the University of Rochester's Administrative Computing Services (ACS) launched a major initiative that responded to the growing need for access to information. ACS recognized that in order to both maintain a stable, responsive, secure environment for its complex enterprise-wide applications (financial, human resource, student, development) *and* to begin providing users with fast, easy access to data of university-wide interest that it would have to break away from the concept that all computing and data would be maintained on one large mainframe computer system.

To maintain the production environment while moving ahead with new information retrieval services and technologies, a three-tiered Information Technology Architecture was adopted.

IT Architecture: Logical View


EIS
Aggregates
Data Warehouse
With Detail
Production Applications
FRS
HRIS
FIST
ISIS

IT Architecture: Physical View


Unix/Sybase
(Warehouse)
campus network
Dept LAN
MVS/ADABAS
(Production Sys.)
Server
(EIS)
Dept PCs

IT Architecture: Layers Are Critical

	Data	Access Method	Tools	DBMS	Processors
Level 1	Production	Central Staff Using Application Screens and Batch	COBOL, Natural	ADABAS VSAM	IBM/MVS
Level 2	Data Warehouse	Departmental Staff Using Ad-Hoc Query & Report	Access, Impromptu, R&R, Clear Access, Business Objects, GQL, InfoMaker	Sybase SQL Server or MS SQL Server	University Server (UNIX or NT-Server) and Desktop
Level 3	EIS Aggregates	Departmental Staff Using EIS/OLAP Tools	Forest&Trees, Pilot, ESSBase, Brio, PowerPlay	Proprietary and/or SQL Server	Dept. Server and Desktop

Along with a new architecture, ACS adopted a phased approach to the task of providing fast, easy access to university data.

Phased Approach To Data Warehouse and EIS

Phase 1: DO SOMETHING! Develop a warehouse using character-based, terminal-host technologies that could use the Rolm Data Lines that connect most offices.

Phase 2: After ethernet connections were deployed to most desktops, convert to relational and client-server technologies for query/report services.

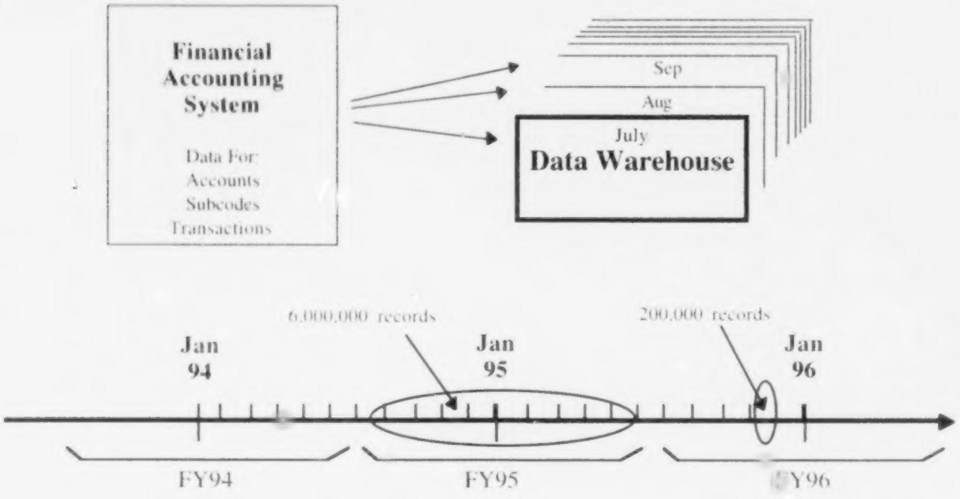
Phase 3: Develop some type of support for senior management.

Warehouse Application Created

According to the plan, Phase 1 was completed using available technologies and a warehouse was developed with data from the University's centralized financial accounting system. Tools used were Focus report-writer and the Focus data base. The warehouse was designed to hold data for the University's seven schools, hospital, and central administration. The Chart of Accounts contains 8,000 unique 6-digit accounts and 100,000 unique 10-digit account-subcode combinations. Each month a snapshot of the financial system was captured and loaded into the warehouse. Approximately 200,000 records are added each month, six million records per year. The current size of our financial data base in the warehouse is approximately 5 gigabytes.

These concepts are illustrated on the next page.

5 Gigabyte Data Warehouse Financial Application
200,000 Records Added Each Month



Conversion to Client-Server

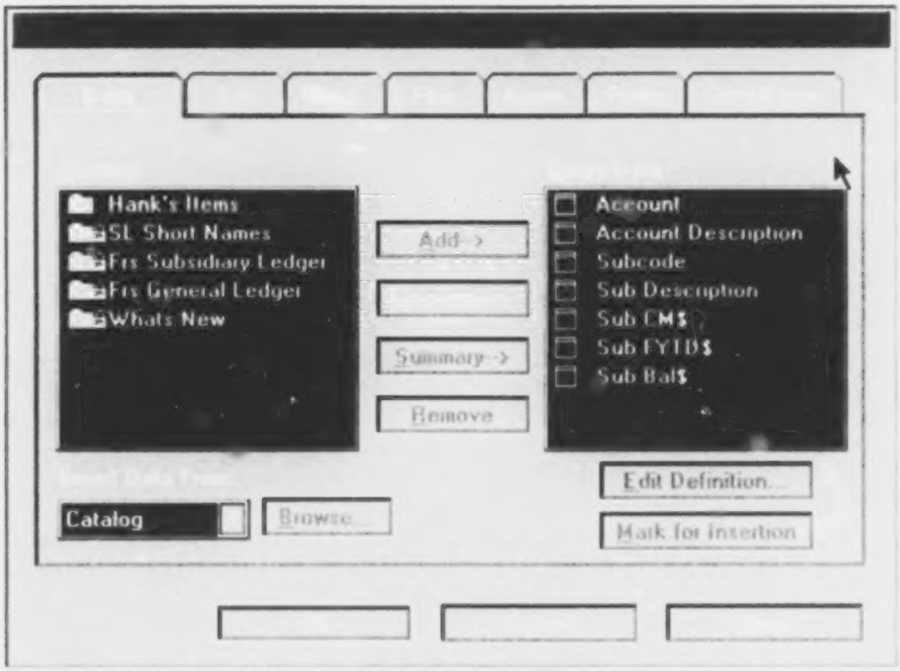
Although Focus was fast and worked well for some people, it was too technical for most office staff to learn. It became an extremely valuable tool for information analysts in central offices such as budget, audit, and financial planning but its learning curve was too difficult for occasional users. It's use as a tool for senior management was not even considered. We accepted this condition as a consequence of the technology and waited patiently for client-server technology to mature.

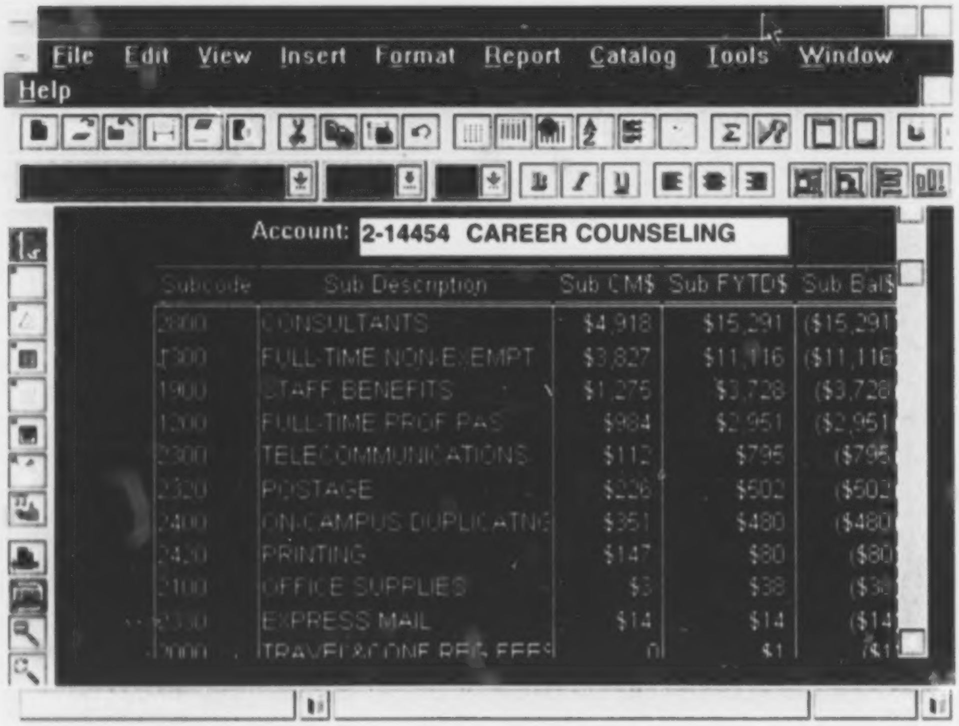
Eventually our campus network expanded and many offices received ethernet connections. Over time we selected Sybase as the relational data base for our warehouse and began converting data from Focus to that platform. As soon as data became available in Sybase we began testing the new toys (i.e. tools) that were available for query and reporting.

Two items became quickly obvious. First, the drag-and-drop, point-and-click, Graphic User Interface (GUI) provided by client-server tools was very attractive, especially when compared to the character-based technologies that were previously installed. Second, performance was slower than with Focus, much slower for some forms of queries.

We spent many weeks experimenting with various tools and forms of data base design ranging from fully normalized to fully denormalized designs. Eventually we settled on a design that gave us good response for most department-level queries. An illustration of a typical query is presented on the next page.

Typical Query Against 5 Gigabyte Data Warehouse (4 second response)


Hank's Items
SL Short Names
Fis Subsidiary Ledger
Fis General Ledger
Whats New
Add ->
Summary ->
Remove
☐ Account
☐ Account Description
☐ Subcode
☐ Sub Description
☐ Sub CM$
☐ Sub FYTD$
☐ Sub Bal$
Edit Definition...
Mark for Insertion
Catalog
Browse...


File
Edit
View
Insert
Format
Report
Catalog
Tools
Window
Help

Account: 2-14454 CAREER COUNSELING

Subcode	Sub Description	Sub CM$	Sub FYTD$	Sub Bal$
2800	CONSULTANTS	$4,918	$15,291	($15,291
1300	FULL-TIME NON-EXEMPT	$3,827	$11,116	($11,116
1900	STAFF BENEFITS	$1,275	$3,728	($3,728
1200	FULL-TIME PROF PAS	$984	$2,951	($2,951
2300	TELECOMMUNICATIONS	$112	$795	($795
2320	POSTAGE	$226	$502	($502
2400	ON-CAMPUS DUPLICATNG	$351	$480	($480
2430	PRINTING	$147	$80	($80
2100	OFFICE SUPPLIES	$3	$38	($38
2330	EXPRESS MAIL	$14	$14	($14
2000	TRAVEL&CONF REG FEES	0	$1	($1

BEST COPY AVAILABLE

Performance: Query/Report vs. Analysis

Response to data retrieval requests varies *widely* depending on at least two major factors; data base design and the type of request submitted. In terms of the data base, we found that a denormalized design with many simple and compound indices works best. One year ago Ralph Kimbal, former President of Red Brick Systems, introduced the notion of a star-schema. Since that time, a number of other articles have appeared praising this design for data warehouse applilcations. Although we have not tested this approach, it certainly looks very interesting.

The type of retrieval requested can also make a *very big* difference in performance. The most common form of a request is one that returns all detail records matching a particular set of conditions. For example, request all subcode records that are year=1996, month=07, account=211706. We refer to these requests as queries or reports. Query/report requests that retrieve data for a specific period of time can run within a few seconds.

Most of the tools that are advertised today are query/report tools. They work best when the user 'filters' (i.e. applies specific conditions) the query which limits the number of records that are retrieved. A small result set is returned to the client workstation where the records are formatted into reports.

In order to expect a timely response, users *must* attach filters to restrict the size of the result set returned from the warehouse. In fact, we encourage new users to 'over filter' their requests to create a small result set until all formatting changes are applied. Once a report is formatted correctly, then remove the excessive filtering to retrieve the desired result.

With the development of data warehouses, another form of request has become very popular, the request for analysis. Analysis requests summarize and aggregate vast amounts of data. Results from analysis requests often appear formatted in a cross-tabular or spreadsheet format. The result set from an analysis query could be *very* large.

Until just recently, if people wanted to produce analysis using client-server technologies, they would often attempt to use query/report tools to perform the task. The very first time that would be atttempted, the performance problem would beceome apparent. Most client-server query/report products don't respond well to large result sets begin returned to the client, *especially* if they have to be further aggregated on the client.

Queries that request data from many months or years can take a *long* time (i.e. hours) to complete. Often Data Base Administrators (DBAs) will be asked to pre-aggregate data into summary tables in order to reduce this retrieval time. Although DBAs need to be able to 'tune' a warehouse to respond to common requests, asking them to out-guess management by creating all of the summary tables they might want is probably not a good use of their time.

An example might help emphasize this important point. The query illustrated on the previous page was very responsive only because we asked for a specific account, month, and year. If we remove the filter for month (i.e. ask for account and subcode data from all months) the response may be very different. The data base optimizer may determine that the number of records that will be returned will be large and so it may change its retrieval mechanism and response time could increase to 3-5 minutes. Summary reports for senior management that pull data for multiple departments or an entire school over a two year period can take 20-40 minutes. University-wide reports that produce multi-year trends can take 1-2 hours to complete!

Types of Queries/Reports

- Simple Lists
- Formatted Reports With Sort
- Groups With Subtotals
- Summary Reports, Crosstabs
- Executive Summaries

Speed of Queries/Reports

- One Month, One Dept/Acct (fast)
- One Month, All Accts (slower)
- All Months, One Act (even slower)
- All Months, All Acts (*very* slow)
- All Months, All Depts, All Acts (**go to lunch**)

This is a dissapointing situation. We want to provide management with the ability to leverage the full potential of historical data but that will not happen with standard query/report tools. In fact, we need to limit the number of analysis queries that retrieve historical data because those queries pull down warehouse performance for the entire community. Moving management queries to off hours might work well but our attempts at convincing senior management to work nights and weekends haven't been successful. So ... until we find a way to access vast amounts of historical data in the same fast, easy manner that we query/report data, management will not be able to maximize the value of this valuable resource.

This is where the University of Rochester found itself exactly one year ago. At that time, the only way we thought we would be able to leverage the great value of our historical data would be to extract subsets for specific departments or vice presidents. The plan was to pre-process this data, compress it, aggregate it and then place it on their department server.

Thank goodness we didn't get into that game. OLAP emerged just in time.

OLAP To The Rescue

In November of 1994, while testing client-server query/report tools, ACS began to hear about a new technology called On-Line Analytical Processing (OLAP). Observing with a casual interest, we were convinced to investigate the new technology after reading an article by Richard Finkelstein titled "Understanding the Need for On-Line Analytical Servers" (see suggested readings at the end of this paper). Several months later, after pursuing several vendors and products, we selected PowerPlay from Cognos for the development of a prototype.

During the Spring of 1995 we began demonstrating PowerPlay to senior management and other IS staff members. Their reactions were all very similar - - spontaneous, short bursts of uncontrolled laughter. They couldn't believe what they were seeing! PowerPlay's OLAP technology was giving us instant access to aggregates from millions of records from our warehouse. The product provided one second response to hundreds of graphic and tabular displays, with drill-down/drill-up between levels of detail and a mouse oriented drag-and-drop, point-and-click interface that was so easy to use, even senior managers could use the product!

Many articles have since been published that explain the features of OLAP, how they work, their costs, and the vendors that have products on the market. A list of several articles that we found to be helpful is presented at the end of this paper.

How does it work?

OLAP technology consists of two major components, the server and the client. Typically the server is a multi-user, LAN-based data base that is loaded either from your legacy systems or from your data warehouse. You don't need a data warehouse in order to implement OLAP but if you have historical data, OLAP's visualization capabilities will reveal patterns of your business process that are hidden in the data.

The Server

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Think of OLAP data bases as multi-dimensional arrays or cubes of data, actually cubes of cubes, capable of holding hundreds of thousands of rows and columns of both text and numbers. The current terminology for these data base servers is Multi-Dimensional Databases (MDDs). The MDDs are loaded from your data source (legacy or warehouse) according to an aggregation model that you define. Fortunately, defining the model and loading the data base can be very easy. For some OLAP products absolutely no programming is required to build the model or to load the data.

The Client

The client component for several OLAP products presents a spreadsheet-type interface with *very* special features. Features available in some products include the ability to instantly change the data component of either the x, y, or z dimension of your spreadsheet using drag-and-drop. You can change your display from tabular to any one of various charts including pie, bar, stacked bar, clustered bar, line, or multi-line - - all with one second response using drag-and-drop. Exception highlighting is another very nice feature. This allows your display to dynamically change font, point-size, and color of rows or columns based upon the value of a component of the display. You can also hide rows or columns based on dynamic values.

Instant drill-down/drill-up is a particularly valuable feature. For example, placing your mouse over a school name and double clicking can invoke a drill-down to department-level numbers. Double clicking on a department can take you down to account-level data. At any point you can then jump from one graphic or tabular display to the next, including multi-year displays, each with a one second response time.

Rapid Development

As stated above some OLAP products require absolutely no 'programming' in order to define an MDD model or to load the data. At the University of Rochester, the average time required to create a model is 20 minutes. The average time to load an MDD is another 20-40 minutes. Therefore we tell our customers "Once you give us a data file, we will have you paging through graphics within one hour." With such rapid development capabilities it is possible to think of EIS solutions that address a short-term business opportunity. In fact, disposable solutions can be considered. Develop a system, use it for 2-4 weeks and then discard it.

Interactive Scenario: Create An OLAP Application

At this point in the presentation, based upon our knowledge of typical financial systems, we will simulate the construction of an OLAP application. In the process of constructing this prototype, several fundamental OLAP concepts will become clear, including the concepts of data dimensions, Multi-dimensional Data Base (MDD), hierarchical data models and steps involved in moving data from a warehouse into an OLAP application.

Our objective is to create an OLAP application that will allow management to view a wide variety of spreadsheets and graphic displays of financial data. Management wants to see financial aggregates by year, month, school ,department, account, subcode, ledger, and various other attributes. They need to see dollars and percents sliced-and-diced by those dimensions. We need to extract data from our Financial Accounting System (MVS mainframe) and load it into an OLAP data base located on our departmental server. We need to:

Identify and Extract Data To Be Used

Identify what views (dimensions) will be most important.
(create diagrams of typical spreadsheets, graphs)
Identify what data must be extracted to produce those views (dimensions).
Write a 4GL program to extract the data into a large flat, delimited ACII text file.

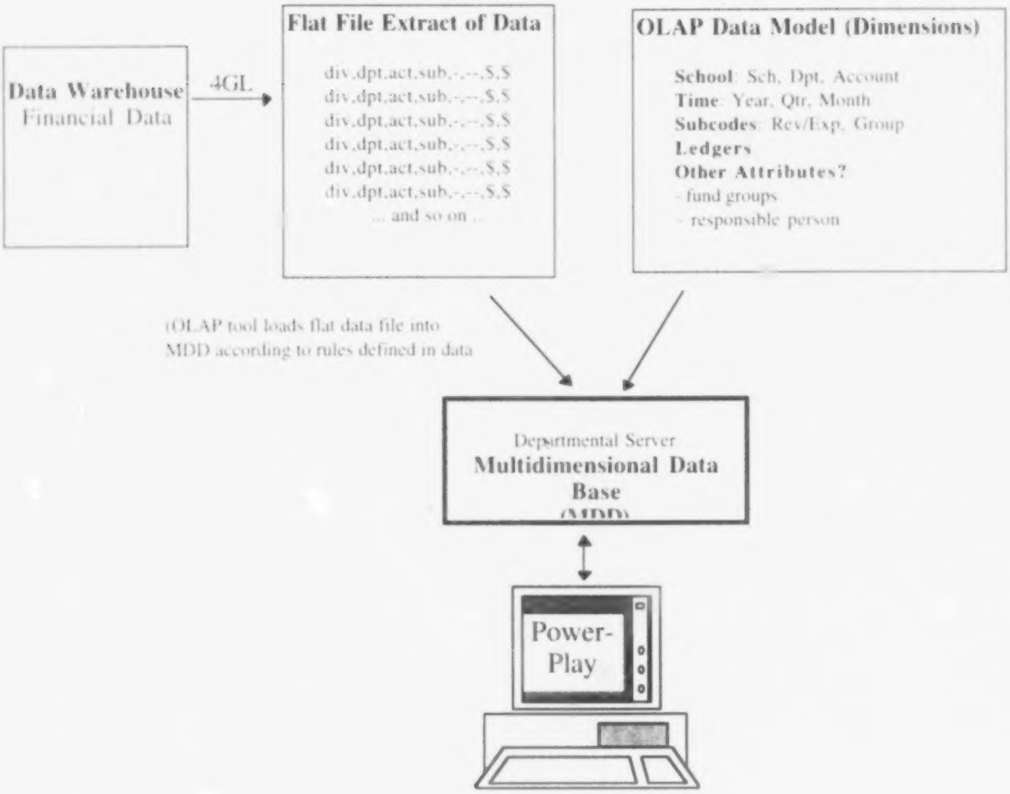
Build an OLAP model

Identify the data dimensions that will be used.
Identify what data items from the extract file will be loaded into what dimensions.
Identify what data items will be measured (added, totaled, summed).

Load The Application

Now we are ready for the final step, load the OLAP data base with data from the extracted file according to the model.

Creating An OLAP Application



Data Warehouse
Financial Data

4GL

Flat File Extract of Data

div,dpt,act,sub,-,--,$,$
div,dpt,act,sub,-,--,$,$
div,dpt,act,sub,-,--,$,$
div,dpt,act,sub,-,--,$,$
div,dpt,act,sub,-,--,$,$
div,dpt,act,sub,-,--,$,$
... and so on ...

OLAP Data Model (Dimensions)

School: Sch, Dpt, Account
Time: Year, Qtr, Month
Subcodes: Rev/Exp, Group
Ledgers
Other Attributes?
- fund groups
- responsible person

(OLAP tool loads flat data file into
MDD according to rules defined in data

Departmental Server
Multidimensional Data Base
(MDD)

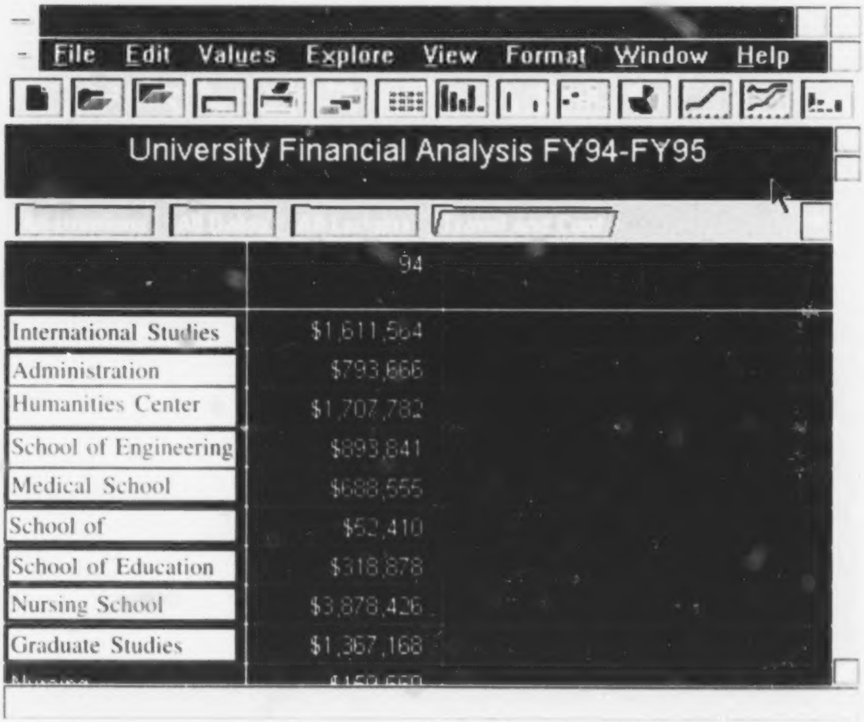
PowerPlay: An OLAP Tool In Action

Here is an example of an OLAP tool in action, PowerPlay from Cognos. During the live presentation of this paper, many screens will be displayed. Only a few are included in the hard-copy version of this report.

Here is a very brief example of a realistic situation. A senior officer needs to do a quick evaluation of Travel and Conference expenditures. The manager launches PowerPoint, selects an MDD, and begins browsing aggregates.

"Let me look at the University's Travel and Conference expenditures."

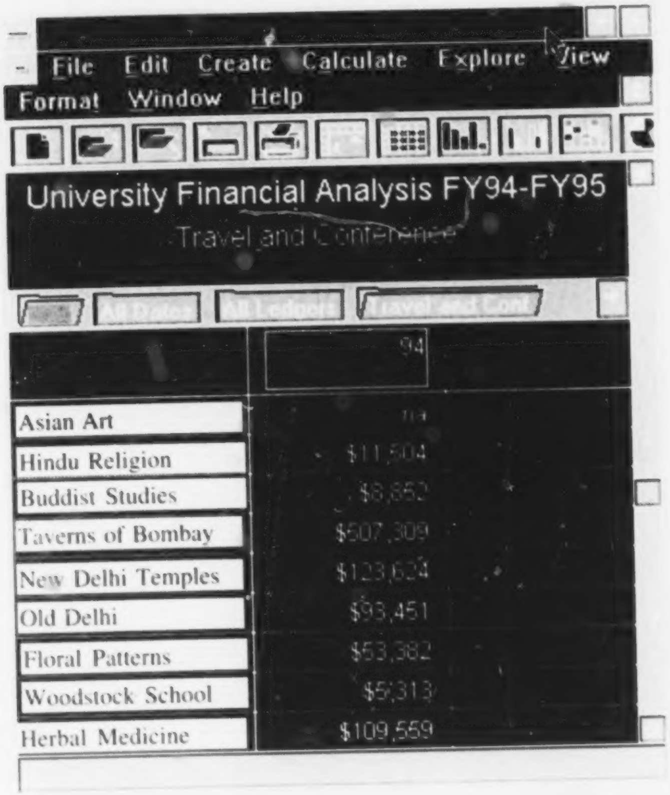
Travel and Expense By College (one second)



University Financial Analysis FY94-FY95

	94
International Studies	$1,611,564
Administration	$793,666
Humanities Center	$1,707,782
School of Engineering	$893,841
Medical School	$688,555
School of	$52,410
School of Education	$318,878
Nursing School	$3,878,426
Graduate Studies	$1,367,168

"Let's take a closer look at the Humanities Center."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Format
Window
Help
All Dates
All Ledgers
Travel and Conf

University Financial Analysis FY94-FY95

Travel and Conference

	94
Asian Art	na
Hindu Religion	$11,504
Buddist Studies	$8,852
Taverns of Bombay	$507,309
New Delhi Temples	$123,624
Old Delhi	$93,451
Floral Patterns	$53,382
Woodstock School	$5,313
Herbal Medicine	$109,559

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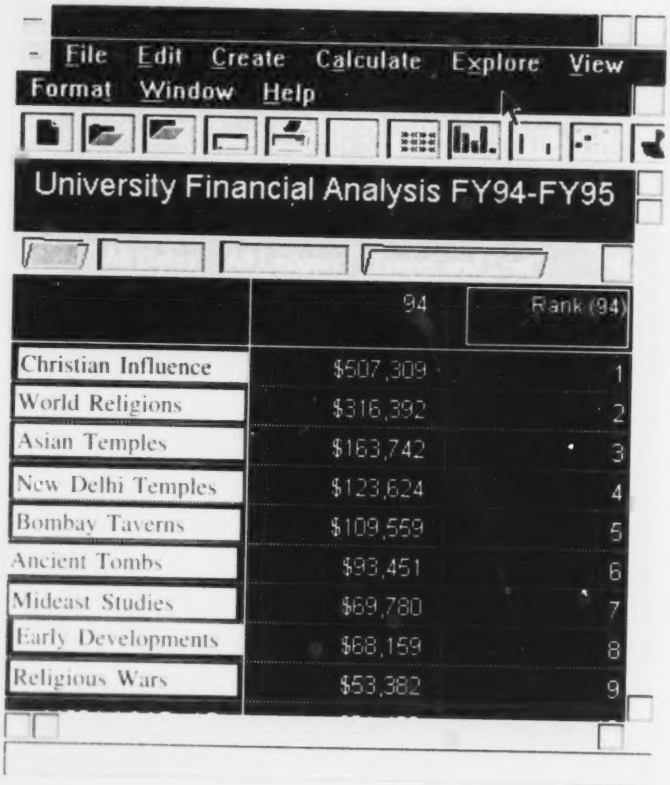
"I wonder which departments are spending the most."


File
Edit
Create
Calculate
Explore
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Format
Window
Help

University Financial Analysis FY94-FY95

	94	Rank (94)
Christian Influence	$507,309	1
World Religions	$316,392	2
Asian Temples	$163,742	3
New Delhi Temples	$123,624	4
Bombay Taverns	$109,559	5
Ancient Tombs	$93,451	6
Mideast Studies	$69,780	7
Early Developments	$68,159	8
Religious Wars	$53,382	9

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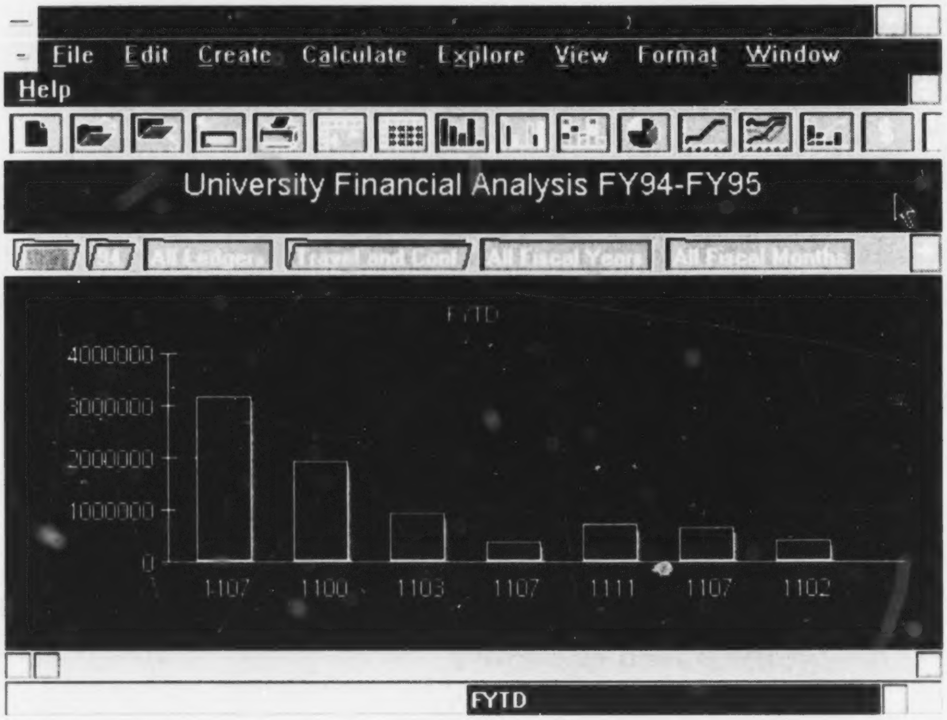
"Let's look at this graphically."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Format
Window
Help
University Financial Analysis FY94-FY95
94
All Ledgers
Travel and Conf
All Fiscal Years
All Fiscal Months
FYTD
4000000
3000000
2000000
1000000
0
1107
1100
1103
1107
1111
1107
1102
FYTD

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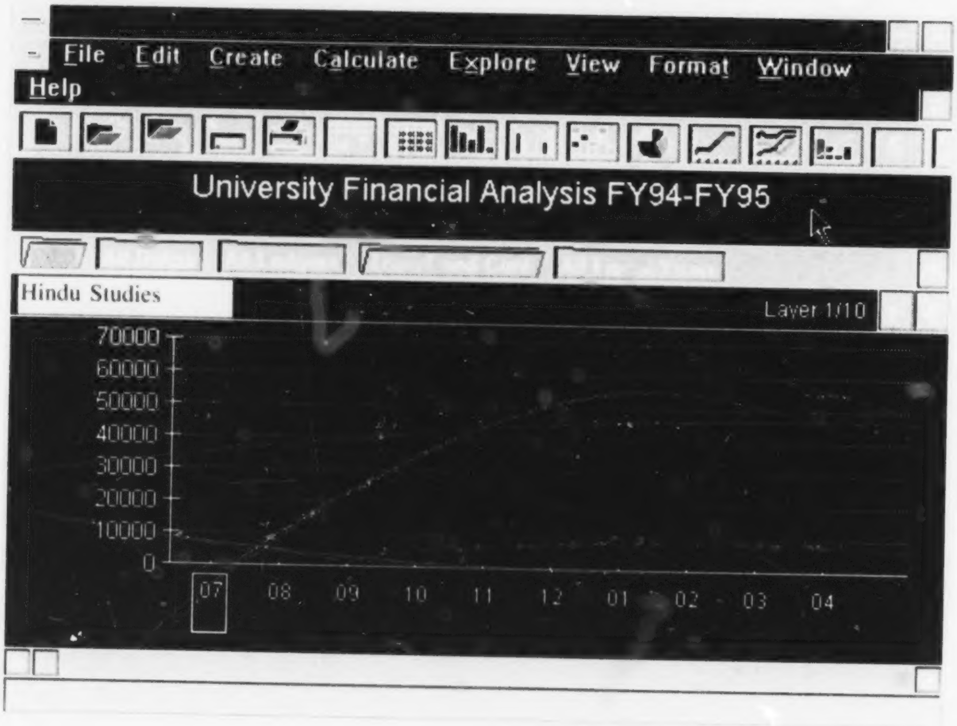
"Let's take a look at their spending patterns month by month."


File
Edit
Create
Calculate
Explore
View
Format
Window
Help
University Financial Analysis FY94-FY95
Hindu Studies
Layer 1/10
70000
60000
50000
40000
30000
20000
10000
0
07
08
09
10
11
12
01
02
03
04

and so on ...

This is an example of the incredibly fast response that OLAP tools provide management. Response is so fast they are able to "browse" aggregates from hundreds of thousands of records. In addition to the instant response, graphic display help them visualize business patterns that are otherwise hidden in their data.

Conclusion

The information retrieval needs of a large organization can become complex and diverse. Adopting an IT strategy that supports multiple layers of technology and data enables an information systems group to respond to those needs in a manner that is flexible and proactive without endangering the performance and security of mainframe production systems.

The development of an integrated data warehouse may become a cornerstone of such a strategy. The existence of a warehouse allows organizations to retain multiple years of historic data. Standard query/report tools can access that data but performance may be very slow. Even if performance is tolerable, special client tools are needed to provide management with the ability to browse historical data in a fast and easy manner. OLAP technologies appear to be the first affordable solution to this challenge.

OLAP technologies compliment existing query/report tools. They 'top off' the data warehouse in a manner that enables senior management to interact with one of their most valuable resources, information.

Suggested Readings

1. Arbor Software Corp., "Multi-Dimensional Analysis: Converting Corporate Data into Strategic Information", Sunnyvale, CA, 1994 408-727-5800 (white paper)

2. Dan Bulos, "Comprehensive Guidelines For Evaluating OLAP Servers", DBMS, August 1995, pps 96-102

3. E.F. Codd, S.B.Codd, C.T.Salley; "Providing OLAP (On-Line Analytical Processing) to User Analysts", Sunnyvale, CA, 1994 Arbor Software Corp.; 408-727-5800

4. Richard Finkelstein, "Understanding the Need for On-Line Analytical Servers", Chicago, 1994 Performance Computing Inc.; 312-549-8325

5. ________. "MDD: Database Reaches the Next Dimension." Database Programming Design, April 1995, pp.27-38

6. Maurice Frank. "A Drill-Down Analysis of Multi-Dimensional Databases." DBMS, July 1994, pp.60-71

7. ________. "The Truth About OLAP." DBMS, August 1995, pps 40-46

8. John F. Rockart & David W. DeLong, "Executive Support Systems", Dow Jones-Irwin, 1988

9. Birgitt Tangermann, "OLAP Product Directory", Data Based Advisor, December 1995, pp 50-53

10. Paul Youngworth, "OLAP Spells Success For Users and Developers", Data Based Advisor, December 1995, pp 38-49

You CAN Teach an Old Dog New Tricks: Extending Legacy Applications to the New Enterprise Architecture

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In 1994, a team of faculty and staff at the University of Pittsburgh completed the design of an enterprise-wide information architecture. The architecture provides the blueprint for developing an integrated set of information services, processes, and technologies, enabling significant efficiencies in business and service processes, and facilitating informed decisions concerning information technology expenditures and acquisitions.

Revolutionary in design, the architecture utilizes pattern-based abstraction techniques to enable evolutionary implementation and intelligent use of legacy systems. This presentation addresses the prototype application programs developed to illustrate sample information processing patterns as well as the look and feel of the envisioned architecture. It focuses on the latest and most ambitious of the prototypes, a client/server application that puts a graphical user interface on a character-based legacy application. This "prototype" is currently in use by faculty advisors and staff in five schools, and is being implemented by several others. It allows the legacy system to be integrated with the University's envisioned enterprise-wide information architecture.

You CAN Teach an Old Dog New Tricks: Extending Legacy Applications to the New Enterprise Architecture

Nicholas C. Laudato and Dennis J. DeSantis
University of Pittsburgh

Background

The University of Pittsburgh is an independent, nonsectarian, coeducational, public research institution. Founded in 1787, it is a state-related member of the Commonwealth of Pennsylvania System of Higher Education. In addition to the main campus in Pittsburgh, the University operates four regional campuses in Western Pennsylvania. Among its five campuses, the University offers over 400 degree programs, and, during the Fall Term, 1994, enrolled 32,519 students (headcount).

In the fall of 1992, the newly-appointed Senior Vice Chancellor for Business and Finance conceived of an initiative to transform the University into a modern organization where information is viewed as an asset and used to strategic advantage. He selected a senior faculty member from the Department of Information Sciences to design and direct a special project. The project director initiated the *Information Architecture and Process Innovation Project* in February, 1993, with four individuals selected because of their background, knowledge and experience with varied components of the University. The Team defined the following mission:

- Design an architecture for the University Information System (UIS) that will provide a framework for making decisions about information systems and for improving the UIS in the future;
- Establish a methodology for business process reengineering using the UIS; and,
- Develop a plan for migrating from the current systems to the envisioned UIS.

The project team made their final recommendations to the University community in June, 1994. The architecture project is documented in *Reshaping the Enterprise: Building the Next Generation of Information Systems Through Information Architecture and Process Reengineering*.[1]

This paper addresses two important features of the UIS architecture and its implementation: the information processing patterns that are central to defining and evolving the architecture, and the prototype application programs developed to illustrate those patterns. It focuses on the latest and most ambitious of the prototypes, a client/server application that puts a graphical user interface on a character-based legacy application. This "prototype" is currently in use by faculty advisors and staff in five schools, and is being implemented by several others. It allows the legacy system to be integrated with the University's evolving enterprise-wide information architecture.

Addressing Legacy Systems

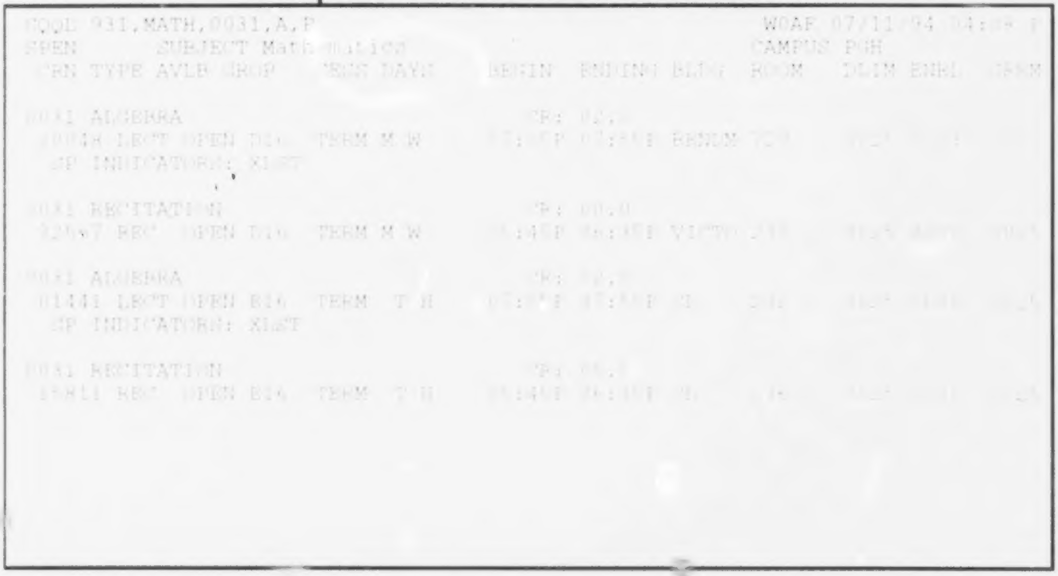
Part of the original motivation for the Information Architecture and Process Innovation Project stemmed from limitations of the University's existing legacy systems. Like most institutions, the University acquired or developed its core business applications over 20 years ago, and implemented them in a centralized IBM mainframe environment. With the explosion of local computing and networking capabilities, individual schools, departments, and administrative units have built local systems to supplement or complement the older central systems. This proliferation of systems has resulted in islands of automation and redundant data.

All of these systems could not be replaced simultaneously, but would have to be addressed in priority order, determined by their importance to the University's mission, their relative state of disrepair, and the relative degree to which they adhere to or contradict the information architecture. Of particular interest was the University's student information system.

The Integrated Student Information System (ISIS) addresses the admissions, financial aid, course, registration, housing, billing, grading, and academic history functions of the University. It feeds the financial, human resources, ID center, and alumni development systems, and is central to the work of the University. ISIS is the newest and best of the University's legacy applications, and works well for its original purpose. It is a character-based application, written in COBOL, that runs in CICS on the University's IBM 3090 mainframe. ISIS is implemented in SUPRA, a quasi-relational, non-SQL compliant database management system from Cincom, Incorporated.

To access ISIS, a user logs into the mainframe via a 3270 terminal session. ISIS transactions are invoked by entering a four-character transaction code, followed by a transaction key. The transaction key specifies parameters for the transaction. For example, the ISIS Course Section List screen is invoked by the "SQQL" transaction code, followed by five parameters: the term code, subject code, course number, availability code, and campus code.

Sample ISIS Course Section List Screen



```
SQQL 931,MATH,0031,A,P                                      WOAF 07/11/94 04:08 P
OPEN       SUBJECT Mathematics                              CAMPUS PGH
 CRN TYPE AVLB GROP   SESS DAYS     BEGIN  ENDING BLDG  ROOM   DLIM ENRL  OPEN

0031 ALGEBRA                          CR: 03.0
 [illegible] LECT OPEN D16  TERM M W     [illegible]
  SP INDICATORS: XLST

0031 RECITATION                       CR: 00.0
 [illegible] REC  OPEN D16  TERM M W     [illegible]

0031 ALGEBRA                          CR: 03.0
 01441 LECT OPEN B16  TERM  T H     [illegible]
  SP INDICATORS: XLST

0031 RECITATION                       CR: 00.0
 [illegible] REC  OPEN B16  TERM  T H     [illegible]
```

ISIS is not compliant with the newly-designed UIS architecture. Its database is not SQL compliant and it is costly and difficult to access in client/server mode. The ISIS user interface is inconsistent with the architecture, and difficult to navigate for the casual user. The transaction keys, in particular, are difficult for the casual user to remember. One course screen may require the user to specify the academic term and course reference number, while a similar screen may specify that the parameters be entered in an entirely different order, or may require additional fields.

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ISIS was designed for the specialist who would use a handful of transactions over and over again each day. For this type of user, the character-based interface is effective and efficient. However, the information needs of the University community have expanded since ISIS was originally designed. For example, academic advisors should have access to their advisees' student records, as well as up-to-the-minute knowledge of what course sections are still available for registration. In many of the University's schools, advising is performed by full-time faculty. As an ISIS user, a faculty member does not match the specialist model.

Compared to the specialist, the average faculty member will have infrequent, sporadic access needs, and may go months between periods of usage. Such users have difficulty retaining the detailed knowledge needed to easily navigate the ISIS screens. If one would compound the idiosyncrasies of the ISIS interface with those of a financial system (faculty often manage research grants), a purchasing system, and a human resources system, the cognitive load required to master several different interfaces quickly becomes a major obstacle to effectively using the information system. In the envisioned information system, the common graphical user interface would resolve this problem.

Pattern-Based Growth versus the Master Plan Approach

Because of the broad scope of the envisioned University Information System, it was clear that its implementation would have to be phased in over several years. The traditional approach to implementation is to specify a detailed ***master plan***. However, one of the problems inherent in implementing a traditional master plan over a period of years is the rapidly changing nature of the technology itself. Components of the solution become obsolete before the solution is even partially implemented. The monolithic architecture ultimately is abandoned as irrelevant to the changing times. To avoid these problems, the project team eschewed the traditional master plan approach in favor of a ***pattern-based approach*** to building the information architecture.

This methodology was inspired by the Oregon Experiment[2], a unique approach used over the past thirty years in designing the University of Oregon campus. The project team's adaptation of the Oregon Experiment approach recognized many parallels between the architecture of towns and buildings and that of information systems.

In the Oregon approach, a set of six core principles serve to guide the building process through the use of a pattern language. The pattern language describes the detailed patterns for towns and neighborhoods, houses, gardens, and rooms. For example, the Oregon architects noted that "When they have a choice, people will always gravitate to those rooms which have light on two sides, and leave the rooms which are lit only from one side unused and empty[3]." In a master plan approach, this insight would translate to blueprints showing two particular windows in each room on campus. After waves of renovations, and with subsequent designs, the intent and specific implementations will both be lost. With a pattern-based architecture, the "light on two sides of every room" pattern stipulates that the architect "Locate each room so that it has outdoor space outside it on at least two sides, and then place windows in these outdoor walls so that natural light falls into every room from more than one direction." After twenty years, the guideline specified in the pattern language still works, whereas the blueprints are completely obsolete.

Creation of a Pattern-based Information Architecture

In a pattern-based approach, the information architecture is documented as a set of patterns based on information processing principles. Decisions about developing, modifying, or acquiring components of the architecture are made by evaluating proposals based on their adherence to the specified patterns. The patterns are subject to on-going review and refinement to ensure that they incorporate advancing technology and continue to meet the needs for which they were designed. The information architecture evolves as more and more projects are implemented that comply with its specifications.

The patterns must be communally designed and adopted, and will guide the design of everything in the University Information System. Patterns can be very large and general, as well as very small and specific. Some patterns deal with the behavior of computer interfaces, some with the distribution of data, some with hardware configurations, some with network protocols, and others with data access methods. More specific patterns deal with report formats, application-specific functions, ordering of data on displays, etc.

In a pattern-based approach, the task of articulating the information architecture becomes one of identifying and documenting the information processing patterns that will underlie all information activities in the envisioned University Information System. This is not a one-time task, but a dynamic, evolutionary activity that requires each pattern to be continuously reviewed and refined. The documentation of the architecture thus becomes a "living document."

The project team identified and outlined a set of information processing tasks they believed to be common across all business applications. A small sample of these tasks are further documented and illustrated as examples of the patterns that form the basis of the envisioned architecture. The first, a ***finder pattern***, is used to identify an object in the database that the user wishes to view. A finder prompts the user for information that could uniquely identify the desired object. If such information is not available, the finder should prompt the user for more general attributes that can be used to search for a collection of objects that meet the specified criteria. In this latter case, execution of the finder would generate a browser. A ***browser pattern*** provides a list of objects, with enough information to allow the user to specify the exact object to be viewed. The next pattern, a ***viewer***, displays the object. The viewer is typically segmented into pages or scrolling sections to allow all attributes associated with the object to be viewed without invoking additional transactions. Viewers also provide "hot button" links to other associated viewers, making it easy to locate related information. Finally, a ***view-before-update*** pattern specifies that you must view the attributes associated with an object before entering a mode that allows you to modify them.

One of the premises of the architecture is that these patterns, among many others, would repeat over and over again in different applications, with only the specific data elements changing from application to application. For example, a student finder would prompt for an ID number, but also allow a search on name; a purchase order finder would prompt for PO number, but allow a search by account number, user, vendor, and commodity; and a course section finder would prompt for term and course reference number, but allow a search by subject, number, and campus. If all of the University's business applications were constructed from such recurring patterns, it would be easy for users to master the interface and seamlessly move from one application to another.

Architecture Prototyping

The information architecture project staff preferred to recommend guidelines that could be implemented using state-of-the-practice technology and reasonably cost efficient methods. For this reason, several of the principles espoused in the architecture statement were illustrated through a set of prototype applications that would serve as "proof of concept." Some of these principles are:

- The client/server model should serve as the basic paradigm for applications in the University Information System;
- All business applications should share a common graphical user interface (GUI), initially based on the Windows GUI, but ultimately embracing multiple platforms (Macintosh, X-Windows);
- The common GUI should provide a consistent look and feel across all applications;
- The common GUI should be easy to learn and use; it should be intuitive and consistent with the standards relative to its particular platform; For example, if an application is running on a Macintosh machine, it should behave as a Mac application, not a Windows one.
- The common GUI should enable easy transferability of skill from one application to the next, and facilitate substitutability of personnel across applications; and
- Applications should easily integrate with desktop personal productivity tools.

The architecture staff completed four major prototypes during the first year of the project.

Course Inventory Prototype

The first prototype, the ***Course Inventory Prototype***, was a Microsoft Windows application created using Visual Basic. The prototype was designed to provide query access to course inventory data that had been extracted from ISIS and converted into an SQL database (Microsoft Access). Because of the relatively static nature of course inventory data, this approach offered an acceptable means of enabling access to the ISIS legacy data. The Course Inventory Prototype illustrated several of the information processing tasks (patterns) that had been articulated in the architecture statement, including the finder/browser/viewer paradigm.

To maximize the reusability of application program code, the first prototype was designed to be as data independent as feasible. For example, instead of hardcoding the association between a database field and its display field in a window, the application used metadata, stored in a relational table, to link all display fields to the database. This allowed developers to quickly create a new window by first creating a new table in the meta-database delineating the required data elements and then cloning a similar existing window.

Application Builder Prototype

The finder/browser/viewer paradigm developed in the first prototype was replicated in a series of six smaller prototypes developed by Information Science graduate students. These student prototypes involved a wide variety of topics, including a classroom scheduling package, a car dealership program, a real estate program, and a purchasing system. This set of prototypes help verify the Team's assertion that the patterns being developed were flexible and generalizable.

Based on the experience of advising the graduate students in using the patterns to create additional prototypes consistent with the architecture, the Team developed a second major prototype, the ***Application Builder Prototype***. This prototype carried the data independence discussed above even further. Twelve of the fifteen code modules created for the first prototype were generalized so they could be completely driven by metadata. The remaining three modules could then be tailored to create a unique application with a finder, browser, and viewer. This allows a programmer to generate a new application simply by creating the metadata and laying out fields on the viewer window. The Application Builder Prototype thus illustrates the possibility of creating an application software library containing reusable software components that embodied the identified patterns.

Class Roster Prototype

Because ISIS is the newest and best of the legacy systems, it is difficult to imagine a set of circumstances that would result in it being given a high priority for replacement. Therefore, it would be highly desirable if it could be cost-effectively modified to better fit the architecture. This means, among other things, that ISIS should have a graphical user interface (GUI) instead of the existing character-based interface. In response to this dilemma, the Information Architecture staff began work on a client/server prototype application to access ISIS data via a GUI front-end.

None of the earlier prototypes were examples of true client/server applications, nor did they wrestle with the problem of accessing the data associated with legacy applications. A new prototype was needed to address these two important issues. The Information Architecture staff polled faculty in the Senate Computer Usage Committee for suggested applications that would be potentially useful to a large number of faculty. Instructors had long expressed the desire to gain easy electronic access to up-to-date class roster information. A class roster is a list of students who are registered for a particular course section. This seemed a simple, but important, topic, so a third prototype application, the ***Class Roster Prototype,*** was initiated with the goals of: (1) illustrating principles of the information architecture, (2) demonstrating the feasibility of client/server technology, and (3) testing the feasibility of accessing ISIS data through existing CICS transactions.

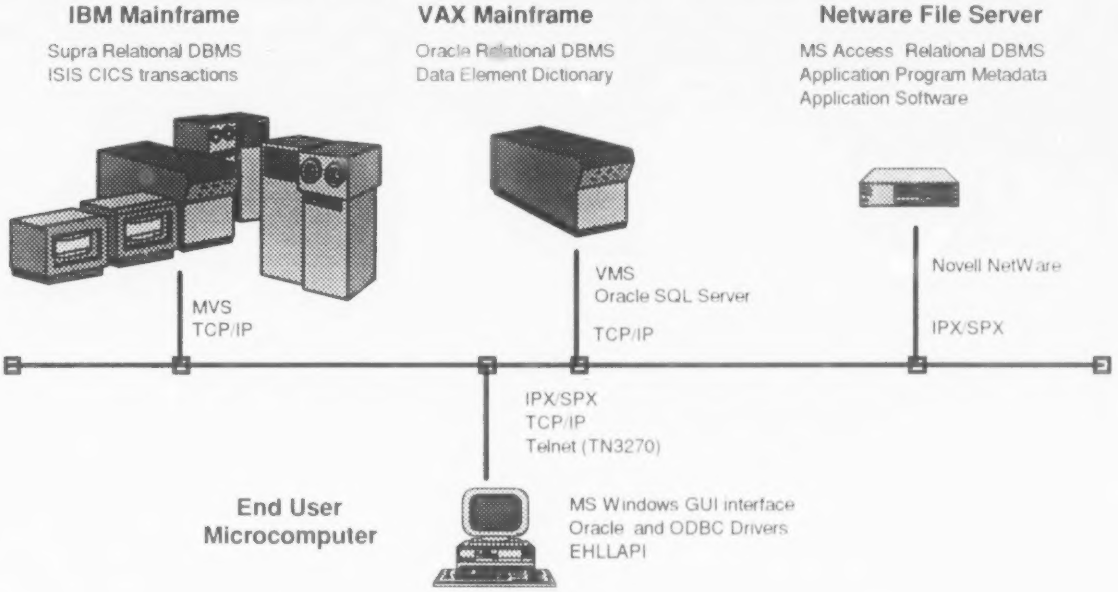
The project development team first sought to access the ISIS data in its SUPRA database. Because no middleware could be found to directly access ISIS data in client/server mode, the project developers decided to employ "screen scraper" technology to access the course and student data through the existing front end CICS transactions. This approach involves building a windows-based client application that establishes a terminal emulation session in the background. The terminal session is then accessed by the windows application via EHLLAPI (Emulated High Level Language Application Program Interface) middleware. The EHLLAPI middleware allows strings of information to be sent to the host terminal session and retrieved ("scraped") from the resultant screens. To the host machine, the terminal session appears to be just another interactive user. At the client workstation, the user may not even be aware that data is being retrieved from a terminal session rather than a database.

Using this approach, the project staff designed an application that would allow a faculty member to interact with a GUI application to access ISIS. The application attaches to the host in background mode, and accesses the existing ISIS CICS transactions to generate a class roster. The class roster window displays general information about the selected course section and displays a scrollable grid containing data about each student enrolled in the course section.

To launch the Class Roster Prototype, the user first logs into an application server, which downloads the required executable images, libraries, and VBX's (Visual Basic Extensions) to the client workstation. The application accesses a meta-database (Microsoft Access) on the server.

1-5-8

This database contains information about the location, length, and type of student and course data on the ISIS screens that would be scraped.


Architecture of Class Roster Prototype

IBM Mainframe
Supra Relational DBMS
ISIS CICS transactions
VAX Mainframe
Oracle Relational DBMS
Data Element Dictionary
Netware File Server
MS Access Relational DBMS
Application Program Metadata
Application Software
MVS
TCP/IP
VMS
Oracle SQL Server
TCP/IP
Novell NetWare
IPX/SPX
IPX/SPX
TCP/IP
Telnet (TN3270)
End User Microcomputer
MS Windows GUI interface
Oracle and ODBC Drivers
EHLLAPI

In the background, the application logs into an Oracle database server, which provides a repository for the University's data element dictionary. The application connects to Oracle SQL Server, and accesses tables containing valid values for ISIS data elements. This component of the system represents "true" client/server technology, where the client application transmits an SQL statement to the server, the server's SQL engine processes the statement, and only the results of the query are sent back to the client.

The actual student and course data reside on the University's administrative data processing machine, an IBM 3090. Behind the scenes and transparent to the user, a telnet terminal session logs into the host production database, using a user-supplied name and password, and subject to standard mainframe ACF2 transaction security. The telnet session then sends transaction strings to the host, which processes the transactions and returns screens of information to the client application. Access to this host data is accomplished through a Visual Basic code module that interfaces with EHLLAPI middleware. The middleware is implemented in the McGill University dynamic link library (DLL) and is accessed via function calls defined in a McGill-supplied Visual Basic code module.

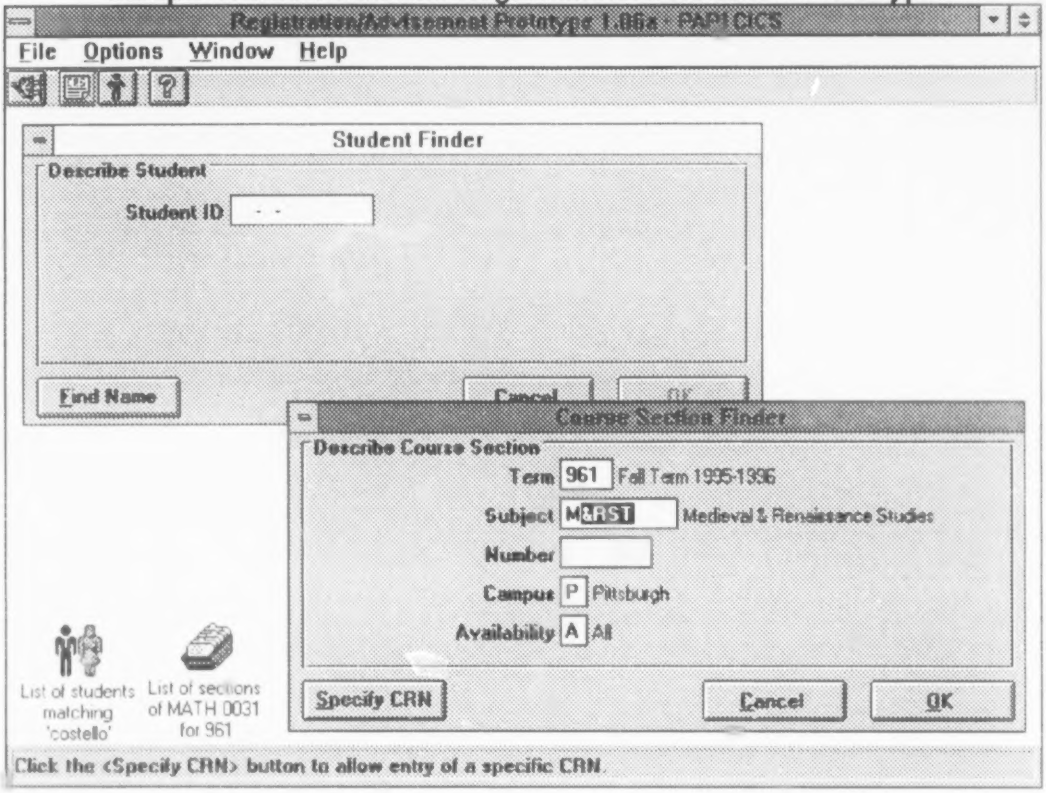
The Class Roster Prototype was a proof-of-concept prototype. It demonstrated a true client/server application that simultaneously accessed a file server, database server, and mainframe. It also illustrated the ability to access legacy system data through the front end CICS transactions.

Registration/Advisement Prototype

The success of the Class Roster Prototype prompted the Director of Student Registration and Financial Services to request that the Information Architecture Team initiate a larger project to develop an application that could be deployed in production mode across the University. The ***Registration/Advisement Prototype*** was intended to create an interface to ISIS that was consistent with the envisioned information architecture, and that would allow faculty advisors to access course and student information and to actually register their advisees into course sections in real time. As did the other prototypes, the Registration/Advisement Prototype was designed to illustrate the principles articulated in the architecture statement. However, instead of proof of concept, it would need to be a working application that would read from and write to the production student database.

The Registration/Advisement Prototype Project was initiated in May of 1994, as a joint venture between the School of Library and Information Science, who volunteered to test the new application, Student Registration and Financial Services, and Computing and Information Services. The Registration/Advisement Prototype used the same technology as the earlier Class Roster Prototype.

Sample Window from the Registration/Advisement Prototype


Registration/Advisement Prototype 1.06a - PAP1CICS
File
Options
Window
Help
Student Finder
Describe Student
Find Name
Cancel
OK
Course Section Finder
Describe Course Section
Specify CRN
Cancel
OK
List of students matching 'costello'
List of sections of MATH 0031 for 961

Student ID

Term 961 Fall Term 1995-1996

Subject M&RST Medieval & Renaissance Studies

Number

Campus P Pittsburgh

Availability A All

Click the <Specify CRN> button to allow entry of a specific CRN.

The sample window from the Registration/Advisement Prototype illustrates two instances of a finder pattern. At the top of the window is a student finder, prompting the user for a student ID. At the bottom, is a course section finder, which is in the mode of prompting for attributes to generate a browser. This mode is relevant when the user does not have the precise information needed to uniquely identify the desired object, in this case a term designator and a unique course reference number. In addition to the two finders, the prototype uses the following windows:

- Browsers: Course Inventory, Course Section, Open Course Section, Student, Advising Records

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- Viewers: Course Section, Class Roster, Student (demographic, registration history, service restrictions), Advising Record, Registration, Academic History
- Update Windows: Student (demographic, registration history, service restrictions), Advising Record, Registration
- Utility Programs: Login/Logout, Change-Password, Download (download to file, send to printer, or copy to clipboard)

This set of windows, through their associated ISIS transactions, can provide access to all of the information that is relevant to an advising and registration session. The advisor can check the student's address information, ensure that the student is enrolled in the appropriate academic program, and ensure that there are no service restrictions (holds) associated with the student's record. This data can be corrected and updated as needed. In addition, the advisor can examine the student's class schedule for any term, as well as the academic record (transcript data) sorted by term or by subject. The advising component allows the advisor to view and create electronic notes and associate them with the student's records. These are stored in a local Microsoft Access database (at a school- or department-level). The advisor can access up-to-the-minute information about course sections, and, if a desired section is closed, even search for alternative sections that do not conflict with the student's schedule. Finally, the advisor can register the student, and give the student a printed confirmation of registration.

The program developers employed an iterative development methodology based on principles associated with rapid application development. This methodology involved the successive repetition of the analysis, design, prototyping, testing, and review steps in close conjunction with the targeted end users. The application underwent seven upgrades using this methodology during its first year of operation. During that time, it was deployed to faculty and staff in the School of Library and Information Science, the School of Education, the School of Pharmacy, the School of Nursing, to the Director of the College of Arts and Sciences Advising Center, and to staff in the Student Registration and Financial Services area, for a total of 90 users. It is also being deployed at the Bradford, Greensburg, and Titusville regional campuses.

By all measures, the Registration/Advisement Prototype has been a resounding success. With the significantly improved access to course and student information, faculty feel much more efficient and effective in fulfilling their advising role. Students have been vocal in praising the responsiveness of the new process. They can do "one stop shopping" in their advisor's office, avoiding a trip to the central Office of the Registrar, and the inevitable wait in line. More importantly, they never have to return to their advisor's office because the course they were advised to take is closed.

The Registration Project

The Information Architecture and Process Innovation team recommended that the architecture be implemented through a project approach. Projects are proposed by design teams that are formed within the administrative and educational units of the University. These teams may be reengineering teams, or they may be smaller incremental improvement teams. The teams propose projects in accordance with detailed guidelines that ensure they will be aligned with the information architecture.

Based on the success of the Class Roster and Registration/Advisement Prototypes, and on the University's long-standing interest in implementing a telephone registration system, the ***Registration Project*** was initiated to investigate ways to improve the registration process.

This Registration Project followed the University's business process reengineering methodology, except for one fundamental point - it did not start from scratch, but rather assumed that the legacy student system (ISIS) would not be significantly changed. Lynch and Werner[4] observed that the most profound element of reengineering methodology is reconceptualizing the fundamental nature of work. The Registration Design Team attempted to meet this goal by including a mix of personnel from several academic, administrative, and technical units. This was intended to foster the notion that such partnerships will produce a better design in a more cost effective manner than if any one of the team components attempted to implement the project alone. The design team concept took advantage of the expertise available across the University and permitted multiple views of the information system project.

The Design Team's recommendations call for further deployment of the Registration/Advisement Prototype, as well as the creation of new capabilities for the related processes of course scheduling and academic advisement. Implementation will be phased in over a three year period, culminating in student self-registration via client/server technology and telephone.

This Registration Project is one of six projects that were proposed as implementations of the UIS architecture. To date, four of the projects have been accepted for implementation: (1) the registration project, (2) implementation of the procurement process (reengineered during the Information Architecture project), (3) reengineering of the human resources process, and (4) acquisition of key components of the infrastructure, such as the site license for the Oracle DBMS and development tools.

Summary

The Registration/Advisement Prototype had its roots as a proof-of-concept application to demonstrate the feasibility of client/server technology and the principles articulated in the University Information System architecture statement. It has evolved into a powerful application that promises to fill an important information need for faculty, staff and students.

Experience during its first year of development and implementation shows that legacy systems can be enhanced with relatively little effort to have the same look and feel as more user-friendly client/server GUI applications. Such enhancements enable legacy data to be available to the occasional user, and not just to the trained specialist. Additional efforts are currently underway to address the other serious problem with legacy systems, the ability to easily access legacy data on the back-end. Consequently, developers believe that legacy systems can be modified to become a viable component of the envisioned University Information System, at least until priorities allow them to be more completely addressed.

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[1] Nicholas C. Laudato and Dennis J. DeSantis, "Reshaping the Enterprise: Building the Next Generation of Information Systems Through Information Architecture and Process Reengineering" *CAUSE/EFFECT*, Winter 1995

[2] Christopher Alexander, *The Oregon Experiment* (New York: Oxford University Press, 1975)

[3] Christopher Alexander, *A Pattern Language* (New York: Oxford University Press, 1977)

[4] Robert F. Lynch and Thomas J. Werner , *Reengineering Business Processes and People Systems*, (QualTeam,Inc., Littleton, CO. 1994)

Strategic Planning for A Library, Computing and Media Support Organization

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Under severe constraints of a public budget in a poor state, the University of South Carolina has examined every phase of services and operations. Central computing, libraries, distance education and media production had been combined for a year when their formal planning process began -- the method, classic strategic planning with broad staff participation. The goal of the process is an ongoing, vital planning process. The panel will look at the method used in planning and the process as well as local roles and issues. The panel will touch on issues of differing professional cultures and of the tensions of change.

The merger of University Libraries, Computer Services and Distance Education and Instructional Support led to the need for division wide strategic planning. Of a total University faculty and staff numbering around four thousand, the resulting Division of Libraries and Information Systems has a staff of over four hundred.

Why plan?

A primary goal of the planning process has been to engage the organization in change in an ongoing way, the better to enable it to operate in a dynamic fashion. Because of its several information "businesses", the University Provost has laid on the Division the burden of leading the University into the next phase of its evolution. Involving all our Division's staff in continual renewal makes it more likely the Division will carry the weight. To emphasize the ongoing nature of planning, "planning process" has been preferred to "plan" as the term for the activities of the last year.

Because of the youth of the Division -- created in October, 1993 --another chief goal of the planning process was and is to create a coherence for the Division. This sense of the whole has been emphasized in every aspect of the process, beginning with an emphasis on broad staff participation.

Let us look at events and then roles in USC's planning process. Then, let's look at cultural factors, critical local issues and current developments.

The Process

A - Establishing the process

The first stage of the planning process lasted for ten months, from October, 1994, to August, 1995, culminating in a report to the chief of the Division, the Vice Provost and Dean. The report claims to be "a formative step in uniting the Division", the result of its "first comprehensive self examination". To reach this milestone, the Division began by choosing a strategic planning consultant to assist in establishing the process. The strategy within the plan was to employ the classic strategic planning approach but to invite broad staff participation. The consultant had us first convene three dozen division faculty and staff from all levels to set the direction for the planning process.

After this retreat, a steering committee was organized, composed of two members each from the three major areas (Computer Services, DEIS and University Libraries), one Division director and two members from beyond the Division (an Associate Provost and the Registrar Emeritus). A Division staff member provided executive assistance.

Over the succeeding nine months, the steering committee devised and executed a process that was divided into three phases: setting a planning framework (Phase I); acquiring information and deriving recommendations (Phase II); clarifying and presenting overall recommendations (Phase III).

B - Discussion (Focus) Groups

In Phase I (November to February), internal assessment began. Controlled discussion groups were held to get perceptions from division employees on key trends, the strengths and weaknesses of their departments and the Division as a whole, the effects of the merger, etc. in a loose agenda of "what works" and "what doesn't work". The interviews were confidential; after careful cross-checking and analysis, summaries were prepared and given to the Dean in

July (Phase III) to provide snapshots of the conditions at the time of the discussion groups.

C - Work of the Units in the Division

To complement the observations of the people of the division, the steering committee asked the eleven who work immediately below the Dean (that is, the Directors) to detail the work of the division's many units. Producing these descriptions took a painstaking effort that extended to the end of Phase II. These documents were termed "Work Processes": specific activities under these rubrics were reported as "Work Projects". These documents all the participants in planning and were included as an appendix in the final report.

D - Communications: Plans and Execution

With the help of the consultant, the steering committee initiated a communications plan. From the time of the original retreat, written and verbal channels were used: an open listserv; a bulletin board to hold significant documents, such as the report of the retreat; open meetings at important junctures to summarize activity and take comment; widely available written and electronic copies of visuals from planning sessions; and communications in regular stafff meetings. From February on (end of Phase I), news of the planning process was sent to all members of the division approximately every six weeks. Tours were offered in December and January to encourage people to familiarize themselves with facilities occupied by other units. General communication was probably increased when faculty and staff interacted on task forces and then returned to their departments.

E - Task Forces

A critical element of the planning process took place in task forces that worked from February to early May (Phase II). The topics of their study flowed from seven overarching categories identified in the October planning retreat: Marketing, Service, Technology, Staffing, Financial Management, Division Infrastructure, and Organizational Coherence. Under these broad headings, more narrowly focused task forces were created.

The focus for each was defined by the steering committee. Once the task forces were formed, charged and trained by the consultant, each launched into the research and analysis of its topic area. Each task force had a designated liaison to the steering committee. The consultant encouraged every group to develop its own way of working: conduct of the task forces varied widely, from chair-less groups to single-leader groups. Each examined and modified the charge as indicated by their expertise and resubmitted the charge to the steering committee for approval. At the end of March (mid Phase II), the task forces presented progress reports. Then they moved to finalize their findings (near the end of Phase II).

The final reports of the task forces, consisting of background, recommendations and sources consulted, were published electronically and printed for circulation to all departments. Comment was invited in open meetings and privately via a comment form.

F - Recommendations and a Published Report

An important activity began in Phase III (June and July): several meetings took place with directors and steering committee for the purpose of interpreting and responding to the recommendations of the eight task forces. The directors separately rated the recommendations (as did Steering Committee members) and then collectively examined them. With the directors' responses in hand, the steering committee sought to establish the most favorable recommendations and bring out points for clarification.

Directors took the opportunity at this point to identify additional topics of promise for the Division at large. A healthy tension was felt between initiating change in the normal course of operations and incorporating these changes in a longer-term framework. The remainder of Phase III (end of July to mid August) was taken up in completing the elements of the report, with special attention to the roughly fifty recommendations and to suggested plans for implementation.

G - Implementing and Continued Planning

When exactly did we begin implementing? Implementation took several shapes.

Because some initiatives were deemed likely to increase Division coherence and efficiency and because they fell outside the scope of any task force, these were undertaken before the report was finished. Collapsing the several courier and delivery services for books, computer printouts, computer and audio/visual hardware and wiring, etc., fell into this category. Another important decision (confirmed independently in Focus Group reports) was taken by management during Phase III: directors and other managers needed leadership and other managerial training to reduce frustration in the Division and increase the quality of outcomes from all Division effort.

After the publication of the report, five of its recommendations were chosen for immediate action. Teams drawn from across the Division were charged with implementing three of these; a suitable plan of attack has not been confirmed for the other two.

A Monitoring Group was convened in late October (i.e., a full year after the start of the process and a two years after the creation of the Division). The Monitoring Group has devised a method of tracking and reporting progress on recommendations and of alerting management when an implementation goes wrong or too slowly. The same day the Monitoring Group began operation, the Steering Committee was discharged.

Did we stop planning? No, but we are not going back to our old way of planning. The report as submitted alluded to "Area Planning" (where "Area" is the terminology used for one of the large parts of the Division such as the Libraries). As amended by the Dean, the continuing planning at lower levels of the Division is being accomplished by a look at services, clients, future trends and proposed new approaches to providing the needed services: this is termed "models of service". By the mechanism of "models of service", each unit is to revise or reinvent itself to provide better service to its clientele while being looking for ways to integrating more closely with other Division units. In this effort, the units are encouraged to stop offering certain extraneous or unaffordable services. The deadline to make this new conception of their departments is March, 1996, six months after the challenge was derived from the report.

Roles & responsibilities

Here then is description of the roles played so far in USC's planning process by the various actors. The consultant facilitates, engages, encourages and suggests models. She trains groups, sets timetables and milestone and launches them into their tasks. She diagnoses and troubleshoot sub-processes in the process.

By design, the remainder of the characters come from the institution. The sponsor (the Dean) acts, choosing to embark on the process, finance it and to champion it. He has pointed out key individuals to invite into the process. He injects direction into the process and pushes for implementation.

We have introduced the two original contractors for the planning service. Next come a number of planning groups. The original planning group (three dozen division faculty and staff) set the direction for the planning process. The nine person steering committee was to manage process, communicate to staff and management, commission and manage task forces and ad hoc groups, and submit a report to the Dean. Both these groups needed courage and confidence.

The Task Forces of Phase II of the process were described above. These investigated their topic areas and reported recommendations. Several of the reports went far beyond the charge, making observations and recommendations which could still be used. Members of these groups balanced the intense two-month commitment with the continued connection to their ordinary duties.

Another type of ad hoc group is exemplified by the discussion groups begun in Phase I. These were organized by a steering committee member with professional training in this area and consisted of a cross-section of people in the areas of the Division. Their role was to comment on conditions in the Division; in so doing, they made useful comments on management, the requirements of their job, virtues of the Division and how things might be improved.

During the course of planning, Directors often convened ad hoc groups from their units to answer questions posed by the Steering Committee and by various Task Forces. This continued past the August report date, to begin the six-month thrust to create new service models. The form and duration will differ with every recommendation, but ad hoc Teams will often be the mode of choice to implement a recommendation.

An "internal consultant" evolved within the Division. One of the directors had begun training himself in facilitation for a different purpose and took advantage -- much to the benefit of the planners -- of the consultant's availability to advance those skills. He helped the Steering Committee and the Directors in Phase III to negotiate through the adoption of recommendations. He also conducted some training for the Steering Committee to make them more effective as a group.

On the several levels below the sponsor come the directors and managers. With managers, the directors cleared people for planning assignments and reassigned work in the interim. The directors reviewed planning recommendations and proposed other complementary ones; after adopting a recommendation, they have confirmed the Strategic Plan's action plan, substituted a design or commissioned a group to carry out the recommendation. Throughout, directors have had to interpret the course of events in planning and then to translate for their faculty and staff, while soliciting their questions and input. They also sought to balance the disruption caused by the planning activity to normal operations and traditional assumptions. This was a role requiring judgment and trust.

What of the rest of the Division? About one hundred of the Division's four hundred members have participated in planning. If one has still not served in a planning or implementing activity, more than forty recommendations will need implementors. In another sense, the whole Division can participate by studying the report and responding.

And the Division's clients? Through the twists and turns in Phases I and II, it became obvious that the Division would first be involved in an examination of internal systems and was not ready for a comprehensive review of services with all the client groups. This activity has awaited the "models of service". With the exception of some Task Force inquiries and a single departmental survey, there was little to go on before the August report. Immediately after, some general topics of campus infrastrucure for academic computing were reviewed. Immediately afterwards, a "Computing Issues Report" was commissioned, to get some clients of academic computing to bring forward some of their general goals and parameters. This should be a good beginning for several of the units as they develop their models of service.

Cultural issues and challenges

In the 'marriage' of the older organizations, both clashes and matches resulted. Several levels of culture clash came into play in the combined information organization: inter-departmental, inter-specialty, intra-organizational. The inter-departmental culture conflict was sometimes based on personality types. For example, when a group of largely introverted, highly organized individuals attempted to wrestle over issues side by side with a group of looser, more extraverted individuals, confusion could ensue or disagreements arise.

Inter-specialty conflicts have more to do with the differences in labor performed rather than with personality; however, differences of this kind have just begun to appear and their effect is difficult to judge. The types of differences have to do with the contrasts among operational, clerical, creative, analytical and other occupational sub-types that work in the Division. It is clear that some in the libraries, say circulation staff, for example, have more in common with operations staff in computer services than either has with collection development or University arcives personnel in the library or instructional developers in distance education. Most helpfully, once the similarities are discovered, a model from one area can be borrowed and applied. Where differences are honored, then different approaches can also be respected.

Intra-organizational conflicts or barriers were found between areas, between units within areas, between management and staff. Discussion groups revealed the extent and pointed toward the causes of some of these. However, relationships predating the planning and even the formation of the Division formed an amicable basis for cooperation in the planning process. For example, it took only five minutes of discussion in the initial planning meeting to point to four successful projects from the previous decade brought about by the combined effort of staff from the three major areas.

Critical Issues

Through the description of events and players above, some critical local issues can be seen. Because of the size of the Division and physical separation of its facilities, communications were especially important. To attempt to have broad staff participation meant using many media and many venues. The Division found its own weak spots -- lack of up to date office addresses, incomplete lists of unit members, outdated titles, no preexisting communications vehicles to address the whole Division, no room big enough for larger planning events, no standard e-mail package in use, no standard word processing package -- addressing these weak spots in itself is creating a more coherent and rational organization.

Planning and operations have come into conflict. If you are not careful, questioning all the premises of gravity and tensile strength while a climber is clinging to the cliff from a rope will alienate you from the climber. Likewise, there is a natural tension at work between the planning and operational mentalities. Management varies in its temperament with regard to profound planning activity. Nevertheless, the involvement of our directors in Phase III of the process produced a far more implementable plan. While some recommendations may not have been included due to management's objections, most were. Having seen them, management also has considered at least superficially how the outcomes of the recommendations might look.

Current Developments

In the original planning retreat, planners took imaginary snapshots of what the Division would be doing in the year 2000. Likewise, they named the values they used or wished to use consistently in their daily work. The first exercise led to the development of vision statements published in the August, 1995 report. As early as the fifth month (end of Phase II, beginning of Phase III), it could be seen that the Division would choose to focus on internal systems, to focus on efficiencies instead of exploring further the territory of values, vision and objectives. (So, for example, the first recommendations undertaken are all five drawn from the categories of Division Infrastructure, Financial Management and Organizational Coherence.)

In the Division's leadershop training, some Division values can be clarified. Useful goals for rank and file to complement the vision statements are most likely to come out the effort to create new service models -- the deadline: March, 1996. It will be interesting to see what happens as a result of our strategic planning process.

Restructuring the Information Technology Organization To Improve User Services and Return on Investment: Do Compromises Work?

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and

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Abstract

In the last several years, Central Michigan University reached a level of technological growth, excitement, and frustration that significant changes in both the information technology infrastructure and organization were necessary. The university employed a combination of external consultants, an internal technology task force, and electronic "town meetings" to discuss and recommend a new organizational approach to implement and support a technology initiative. The resulting initiative will include an expanded campus network, computing system upgrades, new uses of distance learning technologies, and increased coordination of user support services. A new matrix organizational structure for information technology governance was developed that acknowledged the value of both distributed support and a strong central organization.

Many papers and conference presentations have studied the changing information technology organization. A wealth of information on this topic is available at the CAUSE web site (http://cause-www.colorado.edu/). Factors that differentiate institutions and can influence their information technology capabilities and organizations include size, status, funding level, and mission. Central Michigan University (CMU) is a public comprehensive institution with approximately 16,000 students, located in a rural area in the center of Michigan. It is one of fifteen public universities in Michigan, one of a hundred and five higher education institutions in the state. CMU has a large teacher education program and one of the largest colleges of extended learning in the country. The university also runs a tight economic ship. Among our competitor universities in Michigan, CMU is second to last in student tuition and ranks in the bottom third for state funding on a per student basis.

Historical Antecedents to Organizational Change

Mainframes and microcomputers. CMU, like most large institutions, has a mainframe and many personal computers. It would be difficult to discuss the impetus for organizational changes in information technology without mentioning this obvious fact. Most people have a good sense of the power of PCs, even if they are not proficient with their operating systems, applications, or operational features and practices. Many correctly perceive a sharp contrast between the usability of the PC and the capability of a mainframe that they understand even less about than their PC. Almost as many have definite ideas and opinions about PCs and mainframes, what they can and cannot do with them. It has become the *zeichist* to call all mainframes legacy systems to contrast them with PCs and client/server computing The term legacy evolved as PCs became more powerful and were connected to each other in local area networks. CMU has an excess of legacy technology beyond its mainframe that includes some of its personal computers, software, telecommunications equipment, and networking.

This term client/server simply means that data processing is a shared workload of interconnected computers. For large enterprises, client/server computing has become a strategic concern for business productivity and adaptability to change. The most important aspect of this function is empowerment of the user's desktop computing environment and corresponding opportunities for instructional and business processing reengineering. The limit and costs of client/server evolution are indeterminate since personal computers, servers, and networks are still evolving. Technical details, such as standards, interoperability, and security go beyond client/server functional goals but have potentially significant impact and risk. This topic is central to a discussion of improving user services and maximizing return on investment, but now is merely introduced as historical background on the impetus for changing the information technology organization.

Development of the campus network. Significant progress was made in the last three years to create a fiber optic 100Mb/sec FDDI campus backbone network that currently connects thirteen buildings although only a few of these buildings are completely internally wired. The campus network, which now includes about 1,000 nodes, uses primarily Category 5 cable from nodal equipment back to wiring closets. Within-building backbones are multimode fiber. While the current FDDI network was well planned, funding has occurred in piecemeal fashion from faculty grants, departmental or college computer upgrade projects, and state-funded building projects. As use of the network developed, further expansion, management, maintenance, and longer-range planning became a priority.

The current network plan is being revised to upgrade the backbone to a more robust Asynchronous Transfer Mode (ATM) protocol that will provide the capability for both video and data and, eventually voice. In this revised plan, all campus buildings not currently on the network will be added to an ATM backbone. Because of cost, the FDDI backbone will not be upgraded initially but the ultimate goal is to upgrade the entire backbone to ATM. The planned network expansion will include enhanced dialup facilities for off-campus access and network authentication, and software servers to support a distributed computing environment. While the data network was being established, the university's

Telecommunications department was developing the use of interactive television for distance education. Public Broadcasting was also starting to plan new possibilities for educational programming with the anticipated availability of digital television technology. A long-range technology plan will need to evaluate all these potentially important delivery systems.

Decentralized technology. The university currently spends approximately 35-40% of its technology dollars on personal computing and associated support. As end-user computing became more important over the last ten years, decentralized technologies and support became an increasing proportion of total expenditures. Today the issues for decentralized computing are a combination of basic needs such as training, maintenance, support, and upgrades, and production opportunities, such as instructional application development and distance learning, which require an infrastructure of networking and support to be in place.

Technology outside the walls of the university. The development of the Internet and telecommunications technologies have already had some impact on the university's historical involvement in distance education. Until now, the program has been effectively distributed via traditional teaching methods to off-campus students at regional centers located primarily in Michigan and also at other national and international locations. Given the rapid growth of distance learning technology, upgrading this long-lived and successful program is recognized as a critical part of our vision of a twenty-first century university. CMU has started to use interactive television and the Internet to improve educational content and further reduce the constraints of geography on distance learners.

Campus technology organizations and technology culture. For CMU and most institutions, rapid technology-driven change and the realities of finite resources have challenged many elements of their institutional infrastructures.[1] We now need to change the organization to adapt to this growth. The trouble is that organizations are often much more slow to change than technology. An appropriate funding model is a very critical part of the challenge. When funds are plentiful, it is much easier to achieve cross-organizational collaboration, and priorities are relatively easy to negotiate on an informal level. Very few institutions, especially public institutions, are beyond the point where funding and costs are not under tremendous scrutiny. Information technology has high visibility, high cost, and merging functions of voice, video and data. There is also a history of decentralized user constituencies that want control over resource decisions, including technology, that effect them greatly. There would be no impetus to change the campus technology organization if most users were satisfied with the *status quo*.

Approaches to Organizational Planning

When Leonard Plachta became president of Central Michigan University in 1992, he brought with him a view that universities must learn to operate more as a business. He has repeated this theme often, stressing the ideas of the student as a customer, and his gospel of efficiency and effectiveness. In one of his first presidential addresses Dr. Plachta stated his belief that technology was essential to achieve many goals for the university.

> The student is a customer. This statement has been the subject of a continuing debate in higher education. On one side is the view that the faculty-student relationship is unique, i.e., the faculty mentor is a source of knowledge and wisdom--the most likely to be "right." In business however, the customer is often told that they are right. However, both views agree that the student is important--the *raison d'etre*. The business analogy merely serves to stress that education is a business that must offer a quality product at a competitive price.
>
> Faculty must embrace the use of technology to improve teaching effectiveness and efficiency. In the past decade, public education has been and will continue to be under very heavy public scrutiny. It is increasingly possible for educational service providers to offer their services/products to a global

student/customer market via distance learning technologies. Those universities/companies that can offer the best products at the best prices will be successful and those who cannot make the adjustment will falter. This has always been the case in business and education is no different. To become more efficient and effective, faculty and staff must (a) have access to technology that is current, works well, and is easy to use; (b) receive appropriate training and support; and (c) be willing to change.

Influence of technology on the university mission statement. In 1994 our academic mission statement was revised to include goals related to the use of technology. This increased technology emphasis reflected a broad-based understanding of how technology can improve academic outcomes. It is widely believed that technology is escalating the limits of information access and capacity, and creating new opportunities for communication and collaboration. The revised mission statement speaks directly about the role of technology and underscores the faculty commitment to reengineering instructional processes and expanding their vision of the campus and student market.

- "CMU will become a leader in classroom learning technologies to enhance the delivery of education to students both on-and-off campus."
- "In order better to serve its students and the wider community, CMU will:"
- "Employ the latest electronic technologies for the processing and dissemination of information; provide access and training in the use of such technologies to all students, faculty, and staff; and develop new modes of instruction and educational outreach using such technologies."
- "Develop and employ alternative delivery systems to meet contemporary educational needs for a wide range of students whose family or career obligations limit their access to a campus."

Assessment and recommendations of outside consultants. A shadowy future of converging multimedia telecommunications and computing requires difficult decisions about technology, people, budgets, and organizations. Which technologies are necessary? How will technology affect both technical and nontechnical jobs? What is the appropriate balance between cost and benefit? What types of organizational changes are needed to maximize return on investment and provide a competitive advantage?

In 1994, the university sought the advice of a technology consulting firm to assess the current environment and make recommendations about technology change and organizational strategies for how to accomplish the change. The consultant recommended an aggressive transition into a client/server application environment and suggested either (a) reorganizing and refocusing internal technology support or (b) outsourcing. Either of these recommendations suggested considerable change and would impact significantly on the personnel and systems that were in place.

Assessment and recommendations of an internal task force. In January 1995, President Plachta appointed a Task Force on Technology that comprised representatives from many campus constituencies. The Task Force worked on an extremely ambitious timetable, committing a large part of their weekends for several months to discuss and plan technology from an internal perspective. The group did not use the consultant report to guide their work but wanted to be free to explore various objectives and approaches to technology organization. An e-mail list was employed to solicit ideas and opinions from the entire campus. The following set of goals and key activities were developed:

Goals

- Encourage students, faculty, and staff to learn and use basic technologies needed in contemporary society, as well as specialized technologies appropriate to their disciplines and roles.

- Provide and encourage the use of technology to improve teaching and learning, research, and service.
- Use technology to facilitate and improve communication and instructional delivery between and among on- and off-campus constituencies.
- Establish a process for ongoing planning and evaluation of technology initiatives.
- Establish funding mechanisms to acquire, support, maintain, and upgrade basic and specialized technology resources.
- Promote the development of user-friendly applications of technology.

Key Activities

- Establish a technology planning and organization structure.
- Upgrade student computer labs.
- Acquire faculty and staff computers.
- Establish a technology training center.
- Integrate instructional development and multimedia functions into the training center.
- Implement a student technology fee.
- Complete the campus network.
- Improve remote computing capability (Internet access, modem pool, off-campus lines).
- Upgrade the mainframe.
- Upgrade residence hall technology.
- Expand and upgrade library facility.
- Mediate additional classrooms.
- Provide an adequate number of sites with access to on-campus cable television and satellite downlinks. Increase the number of sites on demand.
- Obtain servers and migrate applications from the mainframe.
- Upgrade the telecommunications switch as needed.
- Modify the university budget to allow for repair and replacement of equipment and software.
- Institute incentives for using technology.
- Ensure the implementation of technology in all building and remodelling plans.
- Upgrade library technologies.

- Pursue cooperative links with other educational institutions and agencies.
- Evaluate the technology plan and the success of key activities.
- Support the development of distance learning.

An important charge of the Technology Task Force was to recommend an organizational structure for technology support. One potential structure was to centralize all technology resources under one director. While the task force acknowledged the efficiency of the central model they were concerned with its potential lack of responsiveness to changing needs of both academic and administrative constituents. A second distributed technology model could reverse the advantages and disadvantages of the central structure and would be more responsive but was not likely to achieve any needed efficiencies. There was also a concern about how a completely decentralized organization would plan and coordinate "big technology" projects. The task force recommended a matrix organization and governance structure that combined features of the distributed and centralized models with local service providers in colleges and administrative offices that would be secondarily associated with centralized university technology service centers.

The proposed matrix model[2] included a formal Technology Planning Board chaired by a technology administrator reporting directly to the Provost. The Technology Planning Board would include Deans (or designees) and Vice Presidents (or designees) from all the major divisions of the university. The technology administrator would be responsible for the various technology support services, and promote technology on campus. The planning board would be responsible for strategic planning for technology at the university, including proposals for funding and the schedule for completion of key activities. A second layer of the proposed matrix was the role of technology coordinator. As envisioned by the Task Force, technology coordinators from each division would have more of a technical management relationship with the directors of the centralized service "centers," for computing, telecommunications, and instructional support. This matrix of directors and coordinators would form collaborative operational-level teams of local and centralized service providers.

The Resulting Organizational Structure

In response to the external and internal assessments and recommendations, President Leonard Plachta presented his Technology Initiative Plan in October 1995. The plan endorsed the general recommendations of the Technology Task Force. It stated that the objective of technology was to "support and improve teaching, learning, research and service and to enhance the productivity of students, faculty, and staff." A matrix model for information technology coordination, including a Technology Planning Board and a new Assistant Vice Provost for Information Technology position, were created. The Technology Planning Board included the membership recommended by the Technology Task Force and the Directors of Computer Services and Telecommunications. The Assistant Vice Provost for Information Technology reports directly to the Provost and serves as coordinator of computer services, telecommunications, and other technology units on campus. Also, the technology budget will be under the control of the Assistant Vice Provost. Initially the Technology Planning Board, chaired by the Assistant Vice Provost, received the following charges:

- Develop a plan to complete the campus computer network;
- Develop a comprehensive plan for a Technology Training Center to be integrated with the library instructional resource center and the new technological library expansion plan;
- Develop a job description for a new coordinator of distance learning;

- Consider a comprehensive plan to provide every CMU student with a personal computer to assist them in their university studies;
- Develop a plan that would insure that all faculty members will have appropriate computer access.

The Technology Planning Board will also consider partially financing technology improvements with a student technology fee. These broad charges overlap the most pressing technology-related issues reported by many higher education institutions.[3] However, it is difficult to look too far ahead when there are problems that demand immediate solutions. For example, there is great potential for client/server computing to support instructional and business process reengineering. However, client/server solutions require a ubiquitous campus network, hardware and software upgrades, and lots of training. There are many conflicting sources of information about the cost and timeline to move from a mainframe-centric environment to a distributed computing environment. Many analysts agree that migrating to distributed computing environments will: (a) shift cost structures from being capital-intensive to becoming labor-intensive; (b) at least for the short-term, result in high capital costs due to acquisition of more networking, also new clients and new servers; and (c) occur over a period of years rather than months.

Short and Long-Term Futures

"As it is, we are right on the edge of what works."[4]
(Bill Gates, 1995)

"If you come to a fork in the road, take it."
(Attributed to Yogi Berra)

Bill Gates aptly described the challenge of technology-driven change. The second quotation characterizes the urgency of decisions that face CMU and other institutions. It is important to rapidly move forward with technology planning while taking immediate action on some very fundamental issues and problems that cannot afford to wait. As the campus network is completed, client/server computing will become possible. The empowerment of desktop computing requires managed and coordinated data, communication, and performance optimization. Client/server architecture is an identifiable solution to these needs. However, there are related issues and questions that will need to be solved as we move forward with our information technology initiative.

One issue/problem is to decide the intermediate to long-term value of a mainframe computer as a server in a client/server network. This would not ordinarily be a pressing issue, but our current mainframe is heavily overloaded and usage of existing applications is still increasing at a rapid rate. There are opinions, both pro and con, about the mainframe issue. On the pro side, the proven security and stability of mainframes, rapidly improving price/performance ratios, and operating system evolution into client/server compliant systems seems to offer assurances that an upgraded "legacy" system may serve a substantial future role in a distributed computing enterprise network and can provide a smooth migration path from the mainframe's traditional role as an exclusive server to a future role as a data warehouse and one of many network servers. On the con side, there are concerns that mainframe hardware still has a higher price/performance ratio than smaller servers, is less scalable, cannot be distributed, and is therefore, less flexible. With continuing research and development plus heavy competition among hardware and software vendors, the advantages and disadvantages of mainframes vs. other types of servers are becoming increasingly blurred. Regardless, client/server migration is a complex process that involves improving price/performance ratios for technology but increasing costs on the people side.[5]

A related issue is to how to provide for the significant expenditures related to information technology. This is mostly a function of management of resources but is partly a function of level and permanency of expertise needed to migrate into client/server computing, as well as continued growth with changing technologies. There is little doubt that the cost of technology initiative is high. One way to finance new technology is to discover ways that technology can reduce costs elsewhere. Examples of cost reductions include: relatively lower support costs with centrally managed network-accessible data; reduced use of paper; and as distance learning technologies grow, travel costs can be lowered and physical space can be reduced. Technology can also result in lower personnel costs by automating and streamlining people-intensive processes. This last point is especially important since the most significant cost of higher education involves personnel.

For most institutions, the complexity of technology growth has required very serious consideration of an appropriate balance between in-house information technology staff and external subcontractors. We have taken a very systematic approach in basing these decisions on reliable information. We have learned that external contractors can be used as consultants, project partners, or as an outsource for an entire information technology operation. Such contracts, however, are often finite-term relationships. The transitory nature of most contractual relationships and the importance of mission-critical information systems is a serious concern that should make most institutions wary about overdependence on outside contractors who have little vested interest in the success of an individual institution. It is one option to consider but should be acted upon only after carefully considering all the short and long-term implications.

Issues to be Addressed

Technology standards and trends. One obvious way to reduce technology costs is to standardize hardware and software as much as possible. In most higher education environments, it is virtually impossible to standardize on one platform or configuration. However, arbitrary heterogeneity may result in higher support costs and thus be a false economy. No matter how efficient technology investments are, they will not produce satisfactory returns without anticipating medium and long-term pedagogical, economic, cultural, organizational, market, and technology trends. One example of where many of these issues surface is in the area of distance education. There are many potential delivery systems available for distance learning including interactive television, satellite links, and the Internet. Each of these systems can deliver instructional materials. However, it is important to analyze how comparable outcomes could be achieved with conventional or more cost-effective solutions. The ultimate evaluation of any technology or trend is that whoever can provide the best product for the best price will be the most successful. Every technology purchase is a strategic decision that must balance price vs. performance, obsolescence, and current vs. projected markets and priorities.

Cost of technology modeling. It is essential to understand the real cost/benefit of technology. Since many costs and benefits are hidden or indirect, and because technology involves a combination of one-time and variable length recurring costs, this is a very difficult task. For example, to expand our campus network we not only needed to understand the costs of network technologies, but also physical space, electrical, and engineering requirements for locating the network. In our residence halls, this included additional 117v power capacity needed to support increasing requirements for student televisions, microwave ovens, refrigerators, stereos, hair dryers, and computers. Life-cycles must also be planned for computers, software, servers, and networks[6] although most institutions have not accomplished this.[7] The reality is that technology engineering and support are a combination of direct and indirectly-related investments that must be understood and planned for.

Instructional development, training and incentives. Technology upgrades will accomplish very little if not used effectively to improve instructional and business practices. In a 1993 federal government report, user training and organizational learning were identified as the two most critical technology issues confronting higher education.[8] Besides training, there may need to be related incentives and recognition for innovative and efficient uses of technology. Highly trained users need less support that is one way to justify training costs. Even with trained users some technical support, especially for instructional development, is needed. However, users must also take a more active role in learning how to use technology.

Distance learning objectives and strategies. One technology trend discussed extensively is the involvement with distance education. Historically, the CMU extended degree program, serving more than 12,000 students, has been mostly independent of the on-campus degree programs. Inspired by changing student demographics, increased external competition, and improving distance-learning technologies there is now a sense of common mission and vision between our on- and off-campus programs. The strategic role of distance learning involves selecting the most fruitful technologies to invest in and reengineering instructional delivery. It is important and necessary to assess the relative cost/effectiveness of both traditional and new modes of instruction.

Continuing reorganization of information technology support. The *status quo* of disenfranchised central and decentralized technology support was not working very well. The matrix model for information technology at CMU will try to accomplish more fruitful coordination. A good starting point is to view support from the users' points of view. One solution we are considering is similar to an approach used at Brigham Young University[9] which involved assigning each faculty and staff member to a local computer support representative. This local service provider would be a generalist who would be the primary contact person for all technology needs. Complementing the local service provider would be a central service provider that would receive requests for service, try to answer them immediately, then refer them to the local service provider if necessary. The local service provider would provide many general consulting and technical support services and arrange for additional support and services as needed. The most important aspects of this user support function are (1) effective communications between the central and local service providers, (2) efficient support from the central service providers to reduce unnecessary load on the local service providers, (3) access to technical information, documentation, problem histories, frequently asked questions, and deeper levels of support for the local service providers at their remote points of service.

Conclusions

The various planning processes yielded similar conclusions about the strategic importance of technology growth, broad goals, and an organizational structure for achieving those goals. Details of this organizational change will need further and probably continuing refinements. Some activities, such as expanding the campus network are already underway and are prerequisite to proceeding with both instructional and business process reengineering. The newly created Technology Planing Board will have an opportunity to establish technology priorities, increase efficiency, and achieve the best return on investments. The matrix organization will also have a very exciting opportunity to provide improved user services by coordinating the efforts of local and central service providers. CMU is committed to the technology initiative and has the realization that technology will also require continuing and increased investment. Financing technology will be derived from more streamlined instructional and business processes, student technology fees, and more aggressively pursued external sources of revenue. The university will also continue to evaluate the selective use of external consultants and partners as resources for additional expertise and operational economies.

Footnotes

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The Financial Mythology of Information Technology: The New Economics

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Abstract

One of the most misunderstood aspects of managing information technology is understanding the attendant economics. The rate of technical advancement is accelerating, demand is intensifying, standards and architectures are changing daily, prices are falling, but total costs are growing. Yet the legacy based fiscal thinking of both technologists and financial officers has changed little in the face of these new realities. Understanding the attendant economics of information technology is a necessary first step toward developing sound financial strategies to accommodate technological advancement.

The financial truths surrounding information technology at educational institutions have never been particularly clear. The economics of these investments are often steeped in an intellectual haze that can be described as the financial mythology of information technology (IT). This mythology is nourished by an unusual set of economic and technical factors that often place the financial analysis of IT outside the comfort zone of not only technologists, but financial officers and senior administrators as well.

This paper will show that the principal forces driving the new economics of information technology are: (1) it is steadily increasing in value, (2) academic demand for information technology and computing power is virtually unlimited; (3) the per unit price of information technology is declining rapidly; and (4) the total cost of owning and maintaining these systems is steadily rising. In other words, the potential benefits are truly revolutionary and the demand is insatiable -- but the falling prices mislead many to expect cost savings that will never materialize.

These forces, combined with the breathtaking rate of change inherent in IT, produce a unique economic environment that seems to breed financial paradoxes. The new economics are formidable. Shortening life cycles will force fundamental changes in how institutions manage these assets; the increasing value of IT and the pressure to spend more on it will make the financial crisis facing many institutions worse; and the ability of new technologies to transcend time and distance will intensify competition among institutions. Information technology will represent the single biggest opportunity to either enhance or damage an institution's competitive standing. Academic, technology, and financial leaders will have to come together as never before to address these issues.

The Institutional Context

The potential for information technology to do good is unarguable and contributes to a pervasive mythos that captures the imagination of individuals from every walk of life. In this information era, the expectation is that information technology will be revolutionary and transformational. The record is replete with visionary examples of how individuals, institutions, and society will change for the better -- information will be at our fingertips; ubiquitous nomadic computing will be the norm; productivity will increase; society will experience increased democratization; colleges and universities will provide breathtaking breakthroughs in teaching and learning; and individuals will be free to reach new levels of self-actualization, all as a result of using the new technologies.

However, educational organizations and their patrons must realize that managing the technology revolution will require a focus on financial management that is unprecedented. Unfortunately, it may be fair to characterize the dominant culture of these organizations as being contemptuous of financial activities that attempt to quantify academic endeavors, and suspicious of those who advocate or engage in them. To the extent this is true, these attitudes will need to change if academe is to grapple effectively with the sweeping impacts of information technology. The numbers are going to be too big not to get serious about financial analysis.

In the end, the answer to "if" or "when" these sweeping technical advances will ever take place won't be found on the drawing board of some network engineer, computer scientist, futurist, or even a chief information officer. Instead, these answers will come from the strategic plans and business analyses of pan-university planners, senior business officers, college presidents, trustees, and legislators. This flows from the realization that there is no technical or pedagogical problem involved here as daunting as the bottom line. The technology revolution won't come cheap. Until the business case is quantified and verified, the promise of using information technologies to realize the anticipated benefits will remain just that -- a promise. This paper briefly examines several of the legacy-based assumptions that contribute to the financial mythology of information technology and identifies the new economic realities that IT is bringing to bear on academic institutions.

The Value of Information Technology

The issue of valuing IT investments carries a mystique. The question of how to value technology is being asked at campuses everywhere and is often viewed as a question that is impossible to answer correctly. I propose a new question: Can we value information technology without knowing its value? I believe we can. While we may not be able to assess the value of information technology in some absolute sense, we can clearly observe that its value to our institutions is increasing over time. This is the most critical aspect of value and the one most worth understanding.

The value of IT is increasing. Information technology has tremendous potential. Computers can already talk; they process visual images; and will even have the capability to sense smells in a few short years. It would not be unreasonable within the decade to have our personal computers wake us up in the morning, read us the newspaper, report on the weather, and download the traffic report to our car before we leave for work. Scholarly scenarios have computers assessing prospective students' knowledge base for course placement; managing curricula, interactions, data, and visualizations; and building lifelong connections to scholarship through distance learning technologies.[1] The potential value of information technology is limited only by our imagination and our willingness to invest in change.

What was optional only a decade ago is now so valuable it is a necessity. Neither campus libraries, nor laboratories, nor research facilities would be viable today without computers. Over the last decade we've witnessed revolutionary changes in the level of computing and networking power that resides on the faculty desktop. The technology does so much more than it did a few years ago -- the computer is already indispensable.

The problem is that many people don't realize its increasing value because they have incorporated the expectation for constant improvements into the very nature of information technology. For example, the Commerce Department estimates that 70% of America's top 500 companies use artificial intelligence (AI) in their computing. The quandary is that this innovation doesn't get the credit it's due. Whenever artificial intelligence works, it ceases to be called AI; instead, it becomes an integral part of the system and is then taken for granted.[2] This phenomenon appears to be common whenever an explicit valuation of information technology is called for. Nevertheless, the implicit evaluation is changing. Just as we would be very reluctant to give up our heating, air-conditioning, or phone, we are quickly becoming equally loath to give up our computers.

This paper was written on a computer that corrects my spelling as I type, monitors my e-mail communications in the background, reminds me of important appointments, travels easily in my briefcase, and scans the Wall Street Journal daily for articles relating to information technology -- and it cost less to buy than my first computer purchased ten years ago. More to the point, that original computer wasn't able to do any of these things. This computer is not just more valuable to me than my previous ones, it has become mission critical to what I do.

Each successive generation of information technology brings new levels of performance and functionality that weren't there previously. There is very little information technology on campuses today that couldn't be replaced with something that is both less expensive and superior in performance and function. It seems clear that the value of information technology is increasing from year to year, as well as its respective value to our institutions. IT supports teaching, learning, communications, and collaboration in ways that simply weren't available only a few years ago.

The aggregate value of IT. The total value of information technology is greater than the sum of its parts. To the extent that enterprise-wide systems function in aggregate like ecosystems, much of IT's value grows exponentially as its supporting infrastructure and interconnections grow richer. For example, the value of a departmental e-mail system is enhanced if the entire campus community is also on the network, and is greater still if the campus is connected to the Internet. Similarly, connecting faculty to a campus network would be valuable, but connecting the entire campus community of faculty, staff, and students would be greater still. There is a multiplying effect on the value accrued to the institutional that goes beyond their sheer numbers.

It appears that the cost/benefit curve for technology investments is a step function, where particular levels of investment can produce superb value. The challenge for financial planners is to target the specific level of functionality desired and identify the minimum investments needed to move from one plateau to the next.

The Demand for Information Technology

Years ago Pablo Picasso quipped that "computers are worthless, they only give answers." While his assertion may have had great validity at the time and may still have in philosophical circles, it appears today that his conclusion is completely wrong even though the original reason he gave is still true. The problem for educational institutions is that there's no end in sight to the questions. Thus, there is no end in sight for the demand for the computers and information technology that help provide the answers.

The demand for information technology is driven by more than just the need to answer questions. Successful implementation almost always creates new demand and expectations that grow exponentially. Computationally-intense researchers can bring any quantity of CPU power to its knees simply by relaxing a few restrictions in their models. The challenge is to accept this exponential growth in demand and work to develop financial and management strategies to accommodate it. The academic value of IT systems is growing -- it is only natural to expect individuals, departments, schools, and institutions to desire more of it. The fact that they do is an affirmation that our scholarly values are strong and that our campuses are vigorous.

The demand for large systems. Researchers across a range of disciplines will continue to propose questions that can only be answered using the largest systems available, and once these questions are answered, new and more demanding questions will follow.[3] The need for large machines to help solve large problems will persist and grow. Furthermore, the demand for enterprise wide solutions for data warehousing, e-mail, and administrative functions will drive demand for ever larger central administrative systems. Electronic libraries with digital archives and advanced search and retrieval engines will require large systems currently unavailable on campuses.

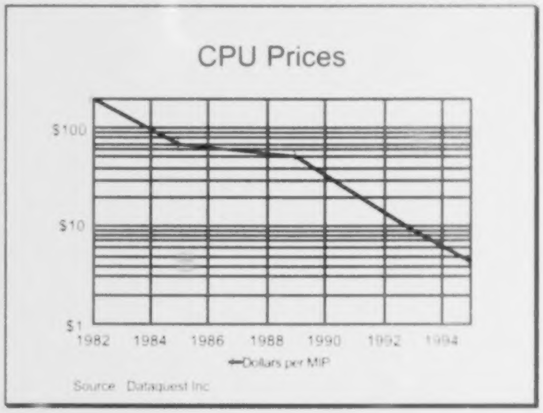
Twenty years ago the entire campus computing capacity was centralized in the academic computing center. Today, personal computers, local area networks, and distributed computing environments have changed that. While it is true that the trend is for central computing to represent a smaller percentage of the total computing resources available on campus, it is equally true that this key resource has been growing in absolute size, and will need to continue growing. Computing power will continue to be deployed throughout campuses at a level that is appropriate to meet aggregate demand. Desktop systems will deliver some minimum level of power suitable for personal use, departmental servers will be larger to meet the demands of multiple users and larger databases, schools will require even more powerful computers and storage systems to meet their demand, and institutions will deploy central academic resources to meet the remaining level of aggregate need. The National Science Foundation identifies this final campus level as the area most in need of financial support and the weakest link in the national pyramid of academic research computing.[4]

The demand for distributed systems. Today's conventional wisdom is heavily in favor of distributed computing systems and client server architectures. Individuals on campus want the greater personal power and freedom of choice that is inherent in these systems. PCs and departmental LANs are increasingly expected to support multimedia, visualization, virtual reality simulations, and disintermediated teaching and learning opportunities. Larger networks are facing similar demands; consider ARPANET, the first large-scale computer network used by faculty. It was originally designed to link computer scientists at universities to distant computers, thereby permitting efficient access to computational resources unavailable at their respective institutions. A minor feature called electronic mail was included only as a sidebar to the host computing function. Yet electronic mail rapidly became one of the system's most popular features.[5] Today, traffic on the Internet is growing at 10% per month, XXX new servers were connected in 1994, and the advent of the World Wide Web is driving even more growth.[6]

Increases in demand. The demand for information technology is not simply a "change in quantity demanded" as prices fall. In this case there is an actual "increase in demand." The subtle difference in this economic jargon is an important distinction with significant ramifications. A change in quantity demanded describes how individuals tend to desire more of almost anything when the price is lower or when their income increases; for example, entertainment, travel, or vacations. Conversely, an actual change in demand describes a shift in the demand curve for that product -- a situation where more is demanded at all price points. This is the case with information technology. This demand characteristic is a major driver of the economics of the entire technology industry. It is what allows technology providers to lower prices continuously. It means that technology manufacturers can expect their revenue, and profits, to grow even as they drop their prices radically.[7] Without this shifting demand function, the economic viability of information technology would be much different than it is today.

The Cost of Information Technology

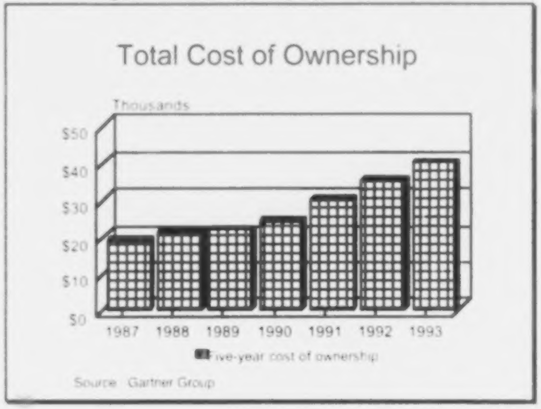
It is commonly reported today that buying computing systems has never been cheaper. By some accounts, the price of buying computers has been halved at least every three years.[8] However, this encouraging news comes with several caveats. First of all, lower per unit prices for individual components of a computer system does not always translate into a lower acquisition price for today's average system. For example, no one would argue that the per unit price of memory, processors, and most peripherals for personal computers has fallen dramatically. On the other hand, as mentioned earlier, today's average user demands more memory, more powerful processors and more peripherals than the average user did three years ago. The end result is that we get a lot more for what we paid three years ago, but in many cases the actual acquisition price may not be falling significantly. Worse yet, demand for even more powerful systems that are now financially viable could actually drive the average acquisition price up.



CPU Prices

Source Dataquest Inc

The second caveat is that the total cost of owning technology is rising. More sophisticated and distributed systems require more technical support, more training, more peripherals, and more time. The price of technology is what you pay to purchase it. The cost includes the price as well as all the other expenses associated with owning, operating, and maintaining it. Every new generation of technology introduces its own unique set of incompatibilities and obsolescence of peripherals. The net effect is a host of new costs that include training, user support, and time to reconfigure networks. As long as total costs are increasing as demand increases, it appears that the best result that institutions can hope for are solutions that support future cost avoidance rather than actual cost reduction.


Total Cost of Ownership

Source Gartner Group

The cost of distributed systems. The growth of distributed computing environments, with their inherent complexity, significantly contributes to the increase in total costs that campuses face. The total cost of distributed systems may be ten times or more the purchase price.[9] These costs, including the opportunity cost of having research faculty administer local computing centers, may very well exceed that of central systems. Moreover, studies by the Gartner Group have shown that the cost of owning and maintaining a PC in a distributed environment has grown steadily over the last five years.[10]

The cost of success. One of the paradoxes of managing information technology is the high cost of success. Successful technology implementations almost always leads to greater expense. A marginally effective e-mail system or networking environment on campus will result in only a limited utilization of the services. However, history shows that once a system becomes functionally viable there is typically an explosion in the number of users as well as in the level of usage. The result is an increase in demand and an increase in total cost as more equipment is needed and better support and training become an imperative.

Emerging technologies will almost certainly repeat this pattern, whether they be distance learning, multimedia, or some other innovation. The shift from traditional paper-based libraries to electronic libraries is a case in point. As libraries move to put more and more electronic information on-line, few if any of their historical services are being displaced.[11] Even though the expectation is that full text retrieval will eliminate the need for books, it may instead create new requirements for printing on demand. The effect is that these electronic services are adding new costs in terms of equipment, training, and operations, with little in the way of cost savings from discontinued activities. There is no evidence that information technology has lowered the total cost of operating academic libraries.

The sociological cost. The largest costs of IT will come from the social changes it produces. Fundamental changes in the positions of individual stakeholders are taking place. Technology is changing the role of libraries and supporting the privatization of information. The advent of distance learning will affect the nature of faculty-student relationships. Changes of this nature will certainly spawn new costs. Strategies that support continuous or incremental change of social norms, not revolution, should dominate in this environment. As John Kotter makes clear, planning for transformations is the wrong goal.[12] Planning for constant incremental change not only produces better results, but can help avoid the most expensive disruptions in organizational effectiveness.

The Economics of Information Technology

As described above, the value of information technology is increasing over time, the demand is swelling, and the price is falling while total cost is growing. How do these observations affect the fundamental economic equations that determine the wisdom of investing in and managing these systems?

Life cycles. The first step toward understanding the new economics of information technology is to realize each new generation has an economic life-cycle that is independent of its functional life-cycle. Computers rarely wear out. Instead, they become economically obsolete and are replaced. The record of academic institutions is littered with examples of technology at every level -- desktop PCs, departmental servers, campus networks, and shared regional super computers -- that have become functionally obsolete long before their hardware stopped working.

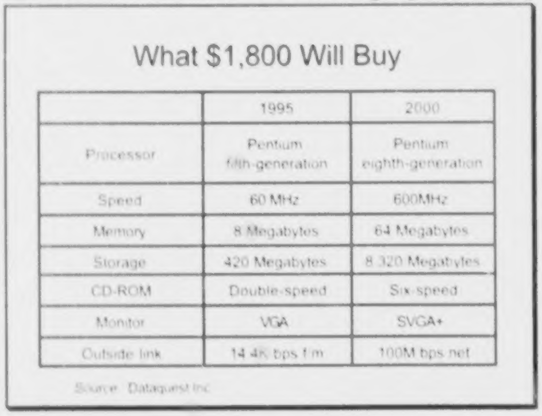
End of life. Recognizing the end of life for information technology equipment is not always obvious, nor is it easy. The problem with determining end of life on most campuses is the decision rule they use. The test on most campuses is, "if it's still running, it must be good for something." The paradox is that a five year old computer still looks and runs as well as it did when it was new, even though it may be obsolete. It does everything it did then and more, and whatever was prone to break has already been fixed. Nevertheless, it may be well past its economic life. An economic life cycle is defined as the useful financial life of an item. In other words, the life cycle is the number of years one should plan to keep a piece of hardware or software. For example, a life cycle of three years for a computer implies that at the end of three years, the computer is either: (1) no longer suited for its intended purpose (e.g., Intel 80286-based servers won't run Netware 3.11), or (2) maintenance and support have grown to the extent that it is cheaper to replace the computer than keep it, or (3) new requirements or performance standards (such as portability, ease of use, user interfaces, visualization, networking, processing power) have necessitated its replacement to meet user needs.[13] Keeping information technology longer than its economic life cycle is a mistake. Not only does it waste current money, but it forfeits the advantages inherent in new technology.

Replacing old technology. When compared to other capital assets, the replacement of information technology systems is unique. The difference with technology is you don't just replace what you had, you upgrade it significantly. Replacing traditional assets, like cars and office furniture, results in something basically the same as what you started with, only newer. On the other hand, a five year old desktop computer (e.g., a 16 MHz Intel 80386-based machine) could be replaced with a 100 MHz Pentium-based, multimedia, portable computer for less money. These two computers are fundamentally different. The new one not only does the old things better, it does important new things that the original didn't. The economic equation has changed.

Determining life cycles. There are several ways of determining technology life cycles that draw on quantitative assessment methods. One is to take into account technology generations. In the simplest example of this method, consider a single faculty member who uses a personal computer to support his or her computationally-intense research. If the area of research is competitive, which is almost always the case, the researcher will need to maintain a competitive level of computing. It could be argued, all other things being equal, that this researcher could afford to be no more than one generation of processing power behind his or her peers -- otherwise the research would suffer from time delays or poor analytical depth. If new CPUs are introduced every three years, the maximum competitive life cycle for this researcher would be six years -- three years for the current generation, and three more for the next. After that, he or she would have to upgrade to stay no more than one generation behind.

Changing life cycles. In the 1980s Intel produced a major new generation of microprocessors approximately every three and a half years.[14] Currently, the time between generations is shorter, perhaps two years or less. The implications for life cycles are obvious -- they're getting shorter. As a result, it's more expensive for institutions to stay on the leading edge and be competitive in the 1990s because of shorter technology life cycles, and it's likely to be even more difficult in the next decade. All indications point to an accelerating rate of technological change which will continue to shorten life cycles.

Even if institutions were to ignore the competitive aspects upon which this generation approach draws, they would still be in for trouble when managing the changes their students will bring to campus. Today, $1,800 buys a 75 MHz Pentium computer with 8 MB of RAM and 500 MB of disk. In five years or less, $1,800 will buy a 600 MHz fifth-generation Pentium computer with 64 MB of RAM, over 6 GB of disk, and an ultra fast network connection. Students will be bringing these machines to campus in large numbers whether they are required to or not, and this alone will drive increased expectations, expensive additions to campus networks, and a need for



What $1,800 Will Buy

	1995	2000
Processor	Pentium fifth-generation	Pentium eighth-generation
Speed	60 MHz	600MHz
Memory	8 Megabytes	64 Megabytes
Storage	420 Megabytes	8,320 Megabytes
CD-ROM	Double-speed	Six-speed
Monitor	VGA	SVGA+
Outside link	14.4K bps f/m	100M bps net

Source: Dataquest Inc

additional support services.

It won't be easy having faculty and seniors using old systems while incoming freshmen enjoy new technological advantages. Expectations are going to rise. Life cycles can't be ignored, nor can they be avoided. Understanding them, accepting them, managing them, and planning for them goes to the heart of the new economics of information technology.

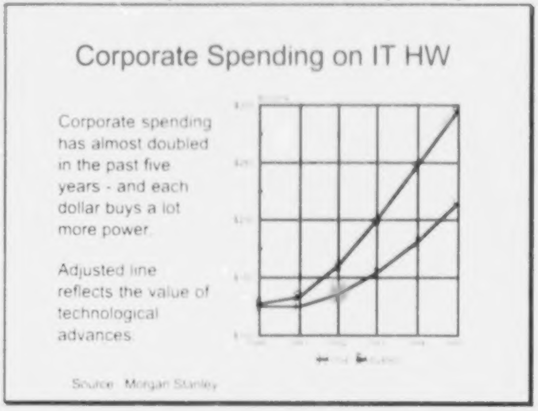
Asset management. The principles of asset management that apply to buying a computer are fundamentally unlike those of buying a truck. If the physical plant purchased a half-ton pickup truck for $25,000, with an expected life of five years, it would have a capital cost of $5,000 per year. At the end of five years, the truck could be replaced with another truck that would cost more but still be more or less functionally identical. (A half-ton pickup truck will still only carry half a ton five years from now.) One way to help make this investment pay better would be to invest more in maintenance and amortize the cost over more years. The rule of thumb to optimize this type of investment is to amortize it for as many years as possible.

Computers, on the other hand, are quite different. If the physics department purchased a $25,000 computer and amortized the expense over five years it would also cost $5,000 per year. The difference comes when considering what happens when the machine is replaced. In this case, the physics department will be able to spend significantly less on the replacement and still receive a new computer that is superior to the one it is replacing. This fundamentally changes the asset management paradigm for this equipment.

Given the superior performance of the replacement machine, the lower price, and the growing demand, the whole premise of evaluating information technology investments by the same methods used to evaluate the truck seems silly. Yet most campuses do just that. A strong argument can be made to turn the model on its ear. Increasing the amortization period for technology investments may actually make the investment decision worse. Instead of buying the biggest computer necessary to do the job for five years, it seems compelling to consider the case of buying the smallest computer that would do the job for three years. The question is, would the physics department be better off buying a $25,000 computer for five years, or a $15,000 computer for three years, and then replacing it sooner? It seems obvious that the second case is superior. It has the same annual cost and the department gets the benefit of replacing it with a superior machine for less money after only three years instead of five. In cases where this is true, the rule of thumb for making computer purchases is to adopt a life-cycle model where you buy as little as possible and keep it for as short a time as possible. The challenge for planners is to balance the constant academic demand for more power today against a financial strategy that will provide for superior power over time.

Saving versus gaining. In the above example, the physics department actually has a strategic choice of how to manage the replacement of technology. At the end of three years the department can choose to either: (1) keep its computing power at a constant level and lower its annual expenditure by buying something with the same power for less money; (2) grow its computing power by holding it spending constant and taking advantage of new economies; or (3) expand its real investment in IT by growing its level of spending. Case one can be rejected as a strategy of stagnation -- regardless of the life cycle length, it assumes no growth in power or capabilities. The strategic choice is actually between holding the capital budget constant or growing it. Current evidence shows that private industry has adopted the strategy of growing its capital budget for IT hardware.[15] Trends showing increased spending on IT among educational institutions suggests that a similar conclusion within the higher education community may be inevitable.[16]

Financial pressures. As long as institutions can expect a continual improvement in their return on investments in information technology, they will be compelled to spend an increased percentage of their budget on it. It is a simple economic reality. Any organization in a competitive environment will be forced over time to invest more of its money where the return is greatest. In the case of information technology, where it pays to invest today, it will pay even greater dividends to invest even more tomorrow. Regrettably, these forces may not always be well understood or recognized explicitly. Nevertheless, they are quite real, and are already affecting most institutions. Many institutions feel the pressure growing to invest more in technology, yet struggle to accept IT's relentless nature. They scrutinize investments on a case-by-case and school-by-school basis but often fail to see the big economic picture inherent to IT investments.


Corporate Spending on IT HW

Corporate spending has almost doubled in the past five years - and each dollar buys a lot more power.

Adjusted line reflects the value of technological advances.

Source: Morgan Stanley

Colleges and universities will have to spend more money on information technology simply because it benefits them to do so -- it's a better alternative than whatever is second best. There is no other asset among their resources that improves its cost/benefit ratio every year. The only other possibility is their human resources. If the return on personnel is increasing, it is almost certainly linked to increased productivity derived from new technology.

The business case. Who is responsible for developing a business case for information technology? Developing a business case for information technology in higher education is difficult. Colleges and universities have their own unique brand of conventional wisdom and peer review that manages most critical decisions well. Information technology seems to be an exception. It doesn't fit well with the existing political system and decision making structure. For example, deans are often out of the loop when it comes to technology issues. They typically don't know much about IT, and faculty tend to bypass them when dealing with computing issues. This is because there's usually an administrative or academic computing organization operating outside of the deans' normal sphere of influence that fields these calls. Exacerbating the problem is the fact that institutional financial officers are also out of the IT decision making loop. That leaves technologists holding the bag for developing the business case.

This shift in authority for decision making contributes to the mythology surrounding the economics of information technology. All three parties -- deans, financial officers, technologists -- see a different set of facts. As a result the business case is poorly understood, under developed, crudely articulated and disseminated, and often misses the key elements of what the analysis should be all about.

The business question. Traditional wisdom governing technology investment decisions views the investment decision primarily as an expense issue. In reality it's a cost benefit issue, where it's an investment in both the goals of the institution as well as the individuals charged with advancing them. No dean or department head would fill a faculty vacancy based solely on the fact that one applicant might be less expensive than another. It should be equally ridiculous to make investment decisions for technology based solely on cost. Moreover, many faculty might actually argue that the "best" possible candidate should always be hired, regardless of cost -- a position few would advocate for technology. The financial decision to purchase and manage information technology cannot be based on minimizing cost, but instead needs to be based on maximizing the net return of the investment.

Teaching and learning. As mentioned earlier, part of the promise of information technology is its tremendous potential to improve teaching and learning. What will be the business case for technologies that support teaching and learning? Are distance learning, multimedia applications, and on-line information services going to be a financial cash cow for colleges and universities? Not likely. Justifying investments in technology for teaching and learning will have to come from either greater benefits (e.g., better student learning), or lower costs (e.g., fewer faculty), or higher revenues (e.g., more students).

It seems unlikely that technology investments will truly be able to disintermediate students from teachers enough to allow for either significant reductions in faculty or increases in students. If information technology should significantly disintermediate student learning from teachers, it would mean that technological solutions to providing education are equally viable to traditional campus experiences. This would create new and alluring opportunities for private companies and could throw our traditional educational model into jeopardy. If the promised disintermediation doesn't prove effective, and teachers are needed in similar numbers and ratios to what is needed today, then the business case for investing in information technology for teaching and learning will rest primarily on a scenario that relies on valuing greater student learning. If this is the case, which certainly appears to be most likely, then institutions will have to grow their technology budgets without significantly reducing their faculty. They will be faced with the hard decision of either raising the price of an education or reallocating current budgets to eliminate inefficient and redundant programs.[17] This prospect is further complicated by the fact that higher education has few mechanisms available for measuring and demonstrating higher value for its primary product.

Fee versus free services. Central computing facilities and libraries face the question of whether to charge for some or all of their services or to provide some or all of them for free. This is often referred to as the "fee versus free" problem. The dilemma faced by these organizations is how to provide the best possible level of service to all possible users while also being efficient and equitable. The history of the debate is best documented in the library literature, where equity arguments generally have prevailed over any scheme to pervasively charge for service.

From a fiscal perspective it is an error to structure the argument in this manner. The issue has never really been a question of fee versus free, instead it is a question of fee versus subsidy -- a much different issue with different implications.[18] In this context, the issue becomes one of assessing the costs and benefits of the entire user community under each of the two possible cases. What is important is that under either of the two schemes there will be a different allocation of costs and benefits to the user community -- although there is no clear answer yet as to who might benefit the most or by how much. However, where services are to be subsidized, the planning task is to determine the appropriate size of the subsidy as well as the primary audience the subsidy is intended to serve. Subsidizing all services to all groups will never be economically viable.

Competitive economics. The biggest institutional downside of new information technologies is its potential impact on inter-institution competition. For example, if distance learning, enabled by IT, becomes viable it could drastically change the competitive landscape. One result would be to break down the regional barriers to competition. If it were financially viable for State College to deliver education at a distance, what is to stop Out-of-State University from delivering competing offerings? A second consideration is that the cost of teaching "personalities" could go through the roof. Like the market for TV personalities, the market for teaching personalities in a distance learning environment could lead to some unpleasant dilemmas for colleges that desire star performers. Assuming that distance learning becomes viable, it implies by definition that new competition will be inevitable. Similarly, if there is new competition, the one thing we can predict with certainty is that there will be winners and losers.

As another example, should the notion of electronic libraries become viable, the potential impacts could be equally dramatic. Consider the case where major Research-I university libraries have, for the bulk of their holdings, on-line searching and full-text retrieval available over the Internet. Library holdings have been, and still are, an important factor in accreditation and institutional ranking decisions. In this electronic library scenario, smaller colleges with more limited financial resources would have an incentive to leverage these on-line libraries and downsize their own facilities, effectively free-riding on the investments of other institutions. If the accreditation process ever recognizes the significant value of "access" to information that the new information highway paradigm emphasizes, wealthier schools with large electronic holdings would have an incentive to either withhold services from the Internet to preserve their status or attach fees to prevent freeloading. In other words, if on-line access to searching and retrieval becomes truly valuable as technology visionaries suggest, large holders will have financial and competitive reasons to withhold it or charge for it.

In either event, the vision of ubiquitous access to free information would be in jeopardy. Moreover, as on-line services in general become more financially viable, the trend of increased privatization of information and education will accelerate -- again threatening the vision as well as changing the economic equations that colleges face.

Conclusion

In summation, one of the most misunderstood aspects of managing information technology is understanding the attendant financial issues. The rate of technical advancement is accelerating, standards and architectures are changing daily, and per unit prices are falling. Yet the legacy-based thinking of both technologists and financial officers has changed little in the face of these new realities. Rationalizing financial strategies to accommodate technological change is an imperative for effective IT investing. Financial officers will have to accept a new set of economic realities that will in turn change how institutions manage their investments in technology. CIOs will have to abandon their dominate financial strategy of positioning IT as a tool for cost reduction, and institutions will have to accept the verdict that they will be spending a greater percentage of their budgets on information technology.

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TRACK 2

POLICIES AND STANDARDS

Coordinator: Charles R. Schomper

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University/College Information System Structures and Policies: Do They Make A Difference? An Initial Assessment

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ABSTRACT: There is a substantial amount of variation in college/university computing structures (e.g., whether the university leadership is consolidated under a chief information officer), computing policies (e.g., the extent to which cost recovery is used), and planning efforts (e.g., the extent to which formal plans are developed concerning information and related policies). Although these policies have been frequently discussed, there has been little systematic research concerning whether these structures and policies have any impact on outcomes such as the extent of access and use made of computing by faculty, staff, and students. This paper draws on the 1994 CAUSE survey to provide an initial assessment of these issues.

INTRODUCTION

Henry Lucas studied the power and prestige of information service departments in 1984 and found that they had little power and visibility in most organizations.[1] But computing is now becoming a central activity of strategic importance to both universities and businesses. For example, Mara points out that the definition of a user of information technology at Cornell has changed from a hundred or so central office users to over 20,000 members of the university community.[2] If colleges and universities are to attract and keep top notch staff, faculty, and students, they need to serve a full range of users and support the teaching, research, and administration needs of their institutions.

To achieve these goals, information managers in colleges and universities need to know what policies are effective. What measures can they take that will help ensure success? For example, in recent years, many universities have spent a great deal of time developing technology plans including strategic, telecommunication, networking, administrative, library, and academic components. Although plans may help to bring about enhanced effectiveness, there is skepticism about the utility of planning because many plans remain on shelves unused. Do universities that construct formal plans (e.g., for networking) have more successful results (e.g., higher percentage of their micros/workstations networked) than those who do not formally plan? Do plans that are updated annually or linked to the budget have more impact?

The Chief Information Officer (CIO) has become a familiar position in universities and colleges. Slightly more than 75 percent of the institutions in the 1994 CAUSE survey reported that there was a CIO, though only about 56 percent said that the CIO is recognized "as such" in their organization. CIOs may come under attack if they are not viewed as being effective. For example, a recent article asked the question, "Is Your CIO Adding Value?"[3] In the private sector, several CIOs have been fired and in the public sector, CIOs have recently become the lightning rods for controversy in several states as one former CIO noted:[4]

> States have to do more with less and they think that technology is going to pull a rabbit out of the hat for them.

University CIOs may come under similar pressure as the strategic importance of computing grows. A recent paper noted that the organizational rather than technological challenges have been most difficult and that there still is disagreement about whether centralized or decentralized structures work best in a university setting.[5] Pitkin studied the role of college/university CIOs and found that they differed from their business counterparts because they did not carry out some roles necessary to be an effective executive.[6] The structure and power of the college/university CIO job can vary greatly. For example, some CIOs (about 18 percent) report directly to the Chief Executive Officer (CEO) of their college or university. About 33 percent report to the Chief Administrative Officer, 19 percent to the Chief Financial Officer, and the remainder report to a variety of others. Does it matter whether there is a CIO or whom the CIO reports to? Is a CIO who reports directly to the CEO without any intervening layers of administration more effective? Does it make any difference as far as use of computers in the curriculum whether the head of Academic Computing reports to the CIO?

Finally, there has been controversy over what budget and cost recovery policies are most effective in encouraging use of computing by faculty, staff, and students. Thomas M. Schwen, head of Instruction Technology at Indiana University, stated that he was worried about a backlash when campus decision makers found that faculty only made use of a tiny fraction (e.g., 1 or 2 percent) of the capabilities of high-tech classrooms.[7] Do student fees and chargeback systems keep students and professors from using the Internet? There have been reports that high network costs have done so.[8] Similarly, do colleges/universities with ongoing budgets (about 35 percent of our sample) for replacing micros and workstations have faculty and students more involved with computing in the curriculum and the Internet? Which policies, if any, positively influence the spread of academic use of computers.

The above questions deserve attention and careful study involving a variety of approaches including case studies, and the employment of experimental and quasi-experimental designs. Our study is exploratory, aimed more at focusing attention on these issues and developing hypotheses than reaching final conclusions about these questions. But the importance of these issues cannot be underestimated. Many people argue that information technology has been slow to permeate the curriculum of colleges and universities. For example, Cotton found that the percentage of courses in which information technology was integrated into the curriculum was 17 percent, no higher than in their kindergarten to high school study.[9] Steger, Williams, McClure, and Smith recently pointed to the dearth of evaluation studies concerning technology expenditures and the need to conduct such evaluations due to the shrinking economic resources available to universities.[10] Can universities modify their policies and structure to improve outcomes? These are the issues that we wish to address here. These are important issues. We hope that this paper will help to stimulate research on this topic.

METHODS

We began this study with a series of case studies conducted during 1993 concerning the structure and role of information technology at five Midwestern colleges and universities. Interviews were conducted with a variety of information technology staff, and also faculty and administrators at each institution. These case studies led to the devlelopment of hypotheses that, with the permission and assistance of the CAUSE staff, we were able to explore through analysis of the 1994 CAUSE survey which contained several relevant questions.

Our CAUSE survey sample used in this paper excludes surveys from 2-year, specialized, and uncoded institutions and the total sample size was 296. The total response rate for the CAUSE survey was approximately 39 percent. There is no way to determine whether, or to what extent, the responding institutions are different from the institutions that did not respond to the survey so caution must be applied to generalizing beyond the respondents to the survey.

As shown in Figure 1 below, we studied four major categories of independent variables (Planning activities, CIO-Organizational Structure, Computer Charge Policies, and Resource Allocation Variables) concerning their impact on the outcome variables. A detailed list of variables employed in the analysis is provided in Figure 2.

Figure 1: Major Variable Groups Studied

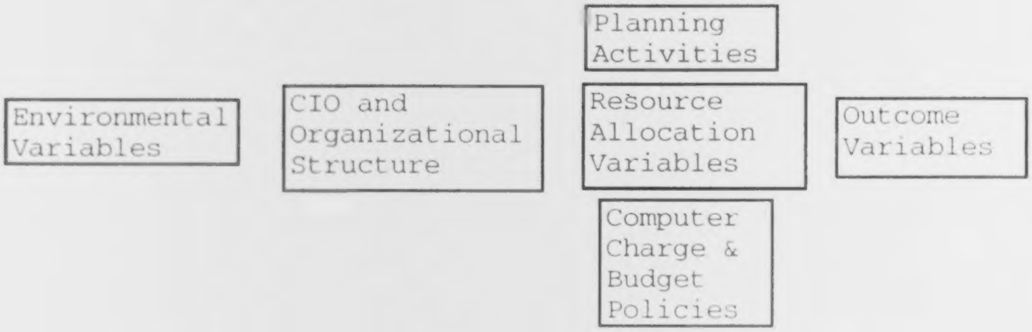
Planning Activities
Environmental Variables
CIO and Organizational Structure
Resource Allocation Variables
Outcome Variables
Computer Charge & Budget Policies

Figure 2
List of Variables Employed in Analysis

Planning Activities

- Institution has overall campus strategic plan
- Institution has IT Strategic Plan
- Is IT plan part of overall plan?
- IT Plan Covers Academic Computing
- IT Plan Covers Administrative Computing
- IT Plan Covers Telecommunications
- IT Plan Covers Library
- IT Plan Covers Networking
- IT Plan Linked to Budget
- IT Plan updated Regularly
- Composite Measure of Planning Activity (0 to 8)

CIO Power

- Is there a CIO?
- IS CIO recognized as such?
- CIO reports directly to CEO
- Academic Computing reports to CIO
- Administrative Computing reports to CIO
- Composite Measure of CIO power (0 to 5)

Computer Charge and Budget Policies

- Are there Student Fees?
- Chargeback (None, Partial, Full) for Academic Computing
- Chargeback (None, Partial, Full) for Administrative Computing
- Is there an ongoing budget for replacing micros/workstations?

Environmental Variables

- Public or Private institution?
- Type of Institution (Carnegie Class)
- Size of Institution (FTE's)
- Index of Resources (Ratio of micros/workstations to FTE's)

Resource Allocation Variables:

- Percent of Faculty with exclusive use of micro/workstation
- Ratio of micros/workstations to students
- Ratio of micros/workstations to faculty
- Ratio of micros/workstations to staff
- Does Institution provide access in dorms to micros?
- Percent of micros/workstations that are academic

Outcome Variables:

- Percent of Faculty making use of software in classroom
- Percent of Faculty making use of computing in curriculum
- Composite Index of Faculty having access to & Using Email, Gopher, & Web
- Composite Index of Staff having access to & using Email, Gopher, & Web
- Composite Index of Students having access to & using Email, Gopher, & Web
- Percent of Academic micros/workstations networked
- Percent of Administrative micros/workstations networked

Our analysis used a variety of statistical analyses including the use of a series of multiple regressions and partial correlation analyses. These techniques allow us to study the impact of several independent variables (the structures and policies of universities) on outcomes simultaneously while "holding constant" (statistically) the infuence of certain environmental variables such as the size of the institution and its resources. It is important to control for size because, for example, the larger universities have more resources that make it more likely that they will construct formal plans. Also, the general wealth of a university may allow it to look good on outcome measures though its plans and policies may not be especially effective. Although our index of resources was crude, examination of institutions high on this variable confirmed that many wealthy private universities scored among the leaders on this index (e.g., Harvard, University of Pennsylvania, Williams College, and Duke University) which supports our argument that this measure helps to control for institutional resources and wealth. We also studied the impact of other potentially relevant variables such as the Carnegie Classification of the institution.

The study has several limitations that mean that we need to view the results as exploratory including the following:

1) Many variables are undoubtedly rough estimates including many of our key dependent variables (e.g., what percent of the staff, faculty, and students have access to and use e-mail, gopher, and the worldwide web).

2) In some of our analyses, there are a substantial number of missing cases for several variables including some outcome measures.

3) Although our analysis examined a large number of potentially important factors, many important variables are undoubtedly missing, especially those measuring the quality of the planning efforts.

4) This is a cross-sectional study and we need longitudinal studies to test for causal relationships among the variables.

Despite these limitations, this study addresses significant issues and raises important questions for university officials seeking to discover what are the most effective policies.

PRESENTATION OF RESULTS

Table 1 summarizes our major findings. One fairly consistent predictor of outcomes was the presence of an ongoing budget for replacing micros/workstations. It was the only predictor of the percent of faculty use of computing in the curriculum and percent of administrative micros/workstations networked. It was also the best predictor of a composite measure of student access to email, gopher, and the Worldwide Web. An organizational structure in which Academic Computing reports to the CIO was the best predictor of the percent of academic micros/workstations networked and a composite measure of faculty and staff access to the Internet. It was the only predictor of the percent of faculty using software in the classroom. It should also be noted that the strength of the above predictors was quite modest, ranging from about 5 to 15 percent of the total variance (out of a possible 100 percent).

TABLE 1:
OUTCOME VARIABLES BY PREDICTORS (IN THEIR ORDER OF IMPORTANCE)[11]

Outcome #1: What percent of faculty make use of computing in the curriculum?
Predictor:
1) Institution has an ongoing budget for replacing micros/workstations.

Outcome #2: What percent of faculty makes use of software in the classroom?
Predictor:
1) Academic Computing Reports to the CIO.

Outcome #3: What percent of the academic micros/workstations are networked?
Predictors:
1) Academic Computing reports to CIO.
2) Institution has ongoing budget for replacement of micros/workstations.

Outcome #4: What percent of administrative micros/workstations are networked?
Predictor:
1) Institution has ongoing budget for replacement of micros/workstations.

Outcome #5: Composite Measure of Staff Access and Use of Email, Gopher, and Worldwide Web.
Predictors:
1. Academic Computing reports to the CIO.
2. There is an ongoing budget for replacing micros/workstations.
3. A composite measure of CIO power (Negative).
4. Institution is public.
5. CIO is recognized as such.

Outcome #6: Composite Measure of Student Access and Use of Email, Gopher, and Worldwide Web.
Predictors:
1. Institution has ongoing budget for replacement of micros/workstations.
2. Academic Computing is covered in the IT plan.

Outcome #7: Composite Measure of Faculty Access and Use of Email, Gopher, and Worldwide Web.
Predictors:
1. Academic Computing reports to the CIO.
2. There is an ongoing budget for replacing micros/workstations.

In the above analyses, we initially excluded the Resource Allocation variables because we wanted to focus on the impact of the structural and policy issues. When we added the Resource Allocation variables to the analysis such as Percent of Instructors with exclusive use of an institutional micro/workstation and student access to micros in their dorms, we were able to predict better the percent of faculty making use of software in the classroom and in the curriculum though the percent of variance explained still remained modest.

SUMMARY AND CONCLUSION

We did find some consistent results in our analysis. Generally, the existence of a plan was not a good predictor of outcomes. The existence of an academic plan did help somewhat to increase overall student access to the internet. But, the existence of IT plan that covered academics did not predict use of computing in the curriculum. Likewise, existence of a networking plan was not a predictor of the percent of micros/workstations networked. Neither updating of the plan nor linking it to the budget proved to be predictors in the above analyses.[12] The quality of the plan effort and the nature of the process may be crucial to plan success and we had no way of measuring these aspects of planning efforts. Institutions in which Academic Computing reports to the CIO were more likely to have superior outcomes. Other CIO-related variables were not important. The fact that the CIO reported directly to the CEO did not have any major positive impacts. The computer charge variables turned out to be generally unimportant--student fees had no statistically significant correlations with the student index of access to the Internet nor use in the classroom or curriculum. The environmental variables (FTEs, public or private institution, Carnegie Classification, and our index of resources) had modest relationships with most of the outcome measures.

To sum it up, our results were mixed. However, the significance of the ongoing budget and academic computing-CIO relationship suggests that budget and structural factors can have impact. Having a budget to replace micros/workstations is a very concrete activity and appears to have a beneficial impact on networking and use of computing in the curriculum. We checked and discovered that having an ongoing budget was not correlated with our measure of resources and wealth (ratio of micros/workstations to FTEs). Our results also suggest that a structure with CIOs in charge of academic computing has a positive impact on outcomes. As expectations concerning information technology continue to soar, colleges and universities need to put more effort into linking their scarce resources (such as time putting together plans) to bottomline results. Although many of the plans, structures and policies did not have much effect on outcomes, perhaps others (e.g., incentives for faculty to use computers) have more effect? Finally, the above research was done using 1994 CAUSE data. In the last year, there appears to have been a revolution in access to and use of the Internet. Has use of computing in the curriculum had a corresponding change? Can we identify any other policies that encourage good outcomes? We need answers to these questions.

NOTES

1. Henry C. Lucas, Jr. "Organizational Power and the Information Services Department," *Communications of the ACM*, January 1984, pp. 58-65.

2. Mark Mara, "Implementing Distributed Computing at Cornell University," Paper delivered at the 1993 CAUSE Conference, Boulder, Colorado: CAUSE.

3. Michael J. Earl and David F. Feeny. "IS Your CIO Adding Value?" *Sloan Management Review*, Spring 1994, pp. 11-20.

4. Tod Newcome, "The CIO - Lightning Rod for IT Troubles?" *Government Technology*, October 1995, p. 58.

5. Joseph J. Branin, George D'Elia, and Douglas Lund, "Integrating Information Services in an Academic Setting: The Organizational and Technical Challenge," *CAUSE/EFFECT*, Fall 1994.

6. Gary M. Pitkin, "Leadership and the Changing Role of the Chief Information Officer in Higher Education," Paper delivered at 1993 CAUSE Conference, Boulder, Colorado: CAUSE.

7. Thomas J. DeLoughry, "Colleges Told to Take 'Disciplined Approach to Technology,'" *Chronicle of Higher Education*, October 27, 1993, a22-a23.

8. See, for example, Thomas J. DeLoughry, "Unconnected: High Network Costs and Low Interest Keep Many Off the Internet," *Chronicle of Higher Education*, February 23, 1994, a19-a20.

9. Carole Cotton, "Talking Turkey About "Real Change,"" Paper Presented at the 1993 CAUSE Conference, Boulder, Colorado, CAUSE, p. 5.

10. Susan F. Stager, James G. Williams, Polley Ann McClure, and John W. Smith, "Assessing the Effectiveness of Information Technology," Paper delivered at the 1993 CAUSE Conference, Boulder, Colorado: CAUSE.

11.Note: The relationships are positive unless otherwise noted.

12. Note that we only present here the composite results for the impact on the use of email, gopher, and worldwide web. We did 18 individual analyses and in a few, the updating and linking of the plan to the budget, did appear as predictors.

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An Outreach Effort - The Connections Program

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Abstract

The Catholic University of America (CUA) School of Engineering and Computer Center are in the process of connecting 15 local-area high schools to the existing campus network to provide Internet access in a project called "The Connections Program."[2] This paper will discuss the partnering experiences, describe the technology used, discuss the development of an affiliation agreement between CUA and the schools, and discuss the importance of developing acceptable use policies. These experiences should benefit other institutions undertaking similar projects.

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[1] Ardoth A. Hassler is former Executive Director, Computer Center, The Catholic University of America.

[2] This work was supported in part by the National Science Foundation under NSF Grant NCR-9417569. The text of the grant is available online at http://www.cua.edu/www/cc_acs/project.

Introduction

There has been a downward trend in engineering enrollment over the past few years. In today's high-technology environment, introducing scientific and engineering concepts early in a student's educational experience is critical in fostering interest in technology. At the same time, an "information revolution" has occurred that requires educators of all levels and disciplines to constantly upgrade their skills. These factors contributed to the need for the Connections Program.

The Catholic University of America School of Engineering has a consortium with Washington, D.C.-area high schools. Through the consortium, many activities are being sponsored by CUA including Engineering 2000, Experiences in Engineering, Telecommunications 2000, Discover Engineering, and The Connections Program. The purpose of The Connections Program, funded by the National Science Foundation, is to expand the successful consortium activities to include providing computer technology to selected high schools in the Washington, D.C. area via a high-speed communication network.

Prior to the inception of The Connections Program, a few local high schools were connected via high-speed modems to a high-powered workstation server located within the School of Engineering. This workstation provides access to a variety of computational resources used in the engineering curriculum, as well as access to the worldwide Internet through the campus network. Funded in part by a grant from the National Science Foundation, The Connections Program extends this benefit to a larger number of high schools. When a high school is in the process of connecting, the School of Engineering provides network consulting expertise, assisting them in getting proper hardware and communications connections.

The Partnerships

The Connections Program would not have been possible without partnerships. From the beginning it has been a collaborative effort between the School of Engineering, the Computer Center, the high schools, vendors, and the National Science Foundation.

Existing Programs for the High Schools

The School of Engineering has an affiliation with the local high schools in the Washington, D.C. area whose goal is to stimulate interest in engineering among high school students. There are currently 14 participating high schools, many of which include a student population with high minority and female enrollments (two of the schools are all-girls). The Connections Program follows several initiatives sponsored by the School of Engineering, and was designed to complement them.

Engineering 2000

Engineering 2000 is presented as a one-week tour of the engineering concepts of the twenty-first century as seen by some of the most exciting of today's practitioners. The program includes a live-in, college-like experience and is intended to attract capable high school seniors to undergraduate engineering curricula. Attendance has grown from 80 (the target for the first year), to 160 (the maximum number CUA can handle with available facilities). The program draws students from all sections of the country, with a strong mix of female attendees (approximately 50%) and a core of black, Hispanic, and Native Americans.

Experiences in Engineering

Experiences in Engineering is a four-week, day program specifically targeting underrepresented minorities. This activity is sponsored jointly by the School of Engineering and the Society of Hispanic Professional Engineers, with partial financial support provided by NASA. Experiences in Engineering is intended to allow multiple-year attendance, up to three years. In addition to presenting an overview of engineering and the process of design, the program has an educational component for which CUA draws on experienced high-school teachers. Another critical component is the use of a high ratio of undergraduate students as teaching assistants to maximize hands-on activity and encourage mentoring. The targeted population is 25 students in each of the three years.

Discover Engineering

A three-hour evening program patterned as a "mini" Engineering 2000 is held specifically at the request of a high school at the CUA facilities. It provides an opportunity for a targeted group to visit the School of Engineering and meet with faculty and students and hear about programs available. This Open House activity is not restricted to the affiliated high schools.

Telecommunications 2000

This summer enrichment program provides a guided tour of the information superhighway and the many career opportunities in the telecommunications industry available to selected high school students. The program gives participants a diverse experience by providing seminars, hands-on laboratory work, and field trips to industry sites.

Computer Center and School of Engineering

Staff of the Computer Center and faculty of the School of Engineering worked together to design a relatively lowcost way to provide connectivity to the participating high schools. They have developed a plan for training faculty, network administrators, and students at the high schools. The result was a proposal that was submitted to and funded by the National Science Foundation. The final proposal and resulting grant were ones that neither group could have obtained on their own. Once the grant was awarded, work began on the building of a support system based on a DEC Alpha server and implementation of NT on servers, both funded by the grant. This involved systems programming staff from the Computer Center, the co-principal investigator in Engineering and two students in the School of Engineering. Originally, the Executive Director of the Computer Center and the Assistant Dean of Engineering served as co-principal investigators for the project. When the former took another job and left CUA, the Assistant Dean of Engineering and the Acting Executive Director of the Computer Center, who had formerly coordinated the training, became co-principal investigators.

Vendor Partnerships

In providing access to the School of Engineering's networked facilities via the Connections Program, the high schools are given access to sophisticated computing tools used in scientific and engineering disciplines, which can be incorporated into classroom activities and projects. Commercially-available packages in mathematics, such as Matlab by The MathWorks, Inc., and Mathematica by Wolfram, Corp., are two targeted applications. These software applications have gained widespread acceptance in the engineering community which thereby assures applicability in later engineering and science studies. A major component of The Connections Program is to provide expertise so that the high schools will be able to effectively integrate these packages into their curriculum. Both vendors have been supportive of the program by allowing their software licenses to be interpreted so that the high school students could use the software at no additional cost.

Another important partnership is with BBN Planet Southeast (formerly SURAnet), through which CUA receives its Internet connectivity. They have provided support to this project by considering the high school affiliates as one entity. Thus, CUA obtained one affiliate membership at a cost of $1,000 per year that covered all of the participating high schools. The project would not have been feasible had each individual high school been required to pay an affiliate membership. BBN Planet Southeast will also be providing training for the participants. This is discussed more fully later in the paper.

The High Schools

The participating high schools are expected to provide their own infrastructure in order to connect to CUA under The Connections Program. Expertise among the schools varies. Most use Intel-based MS-DOS/Windows equipment, however, one school uses Macintoshes. When necessary, the co-PI in Engineering and his students provide technical assistance as the schools move to build local-area networks.

The National Science Foundation

In August 1994, CUA was awarded a grant from the National Science Foundation. It provides for equipment to be purchased for the high schools, the purchase of the DEC Alpha Workstation in Engineering, an expansion of CUA's backbone network to accommodate the school's connectivity, funds to hire graduate students to assist with the implementation, and some operating monies. As in-kind contributions, CUA upgraded its 56KB link to the Internet to T1 and made other enhancements to its backbone network.

The Technology Used

The network architecture relies on the most up-to-date technology in order to achieve the necessary functionality. It consists of several workstations performing specific tasks. A Sun SparcStation, named "Goofy," is responsible for maintaining the yellow pages. The administration of databases that contain user ID's, passwords, group names and host names with their corresponding IP addresses is simplified using the yellow pages services. The configuration has one yellow pages server (Goofy) and each workstation is a yellow pages client.

A DECstation 5100, named "Pluto," is responsible for maintaining the file system. All disks on the system are Network File System (NFS) mounted. NFS mounted disks allow users to access files in different systems as if they were local. The Internet AlphaServer 1000 4/200, running under the DEC UNIX operating system, serves the applications, including Matlab and Mathematica, for The Connections Program.

In order to provide remote system maintenance from the network site to the high schools, a Pentium PC is used as a Windows NT Server. This PC will also be used as the Web Server for this project, which is envisioned as the main tool for collaborating on the project and disseminating the results. Other conferencing tools, only now becoming available, are also being investigated. One CISCO router is connected to a bank of sixteen V.34 modems that are accessible to the participating high schools. The other CISCO router provides connectivity to the CUA Computer Center, which allows access to other resources crucial to this project such as the Internet connection and the library catalog. A block diagram is shown in Figure 1.

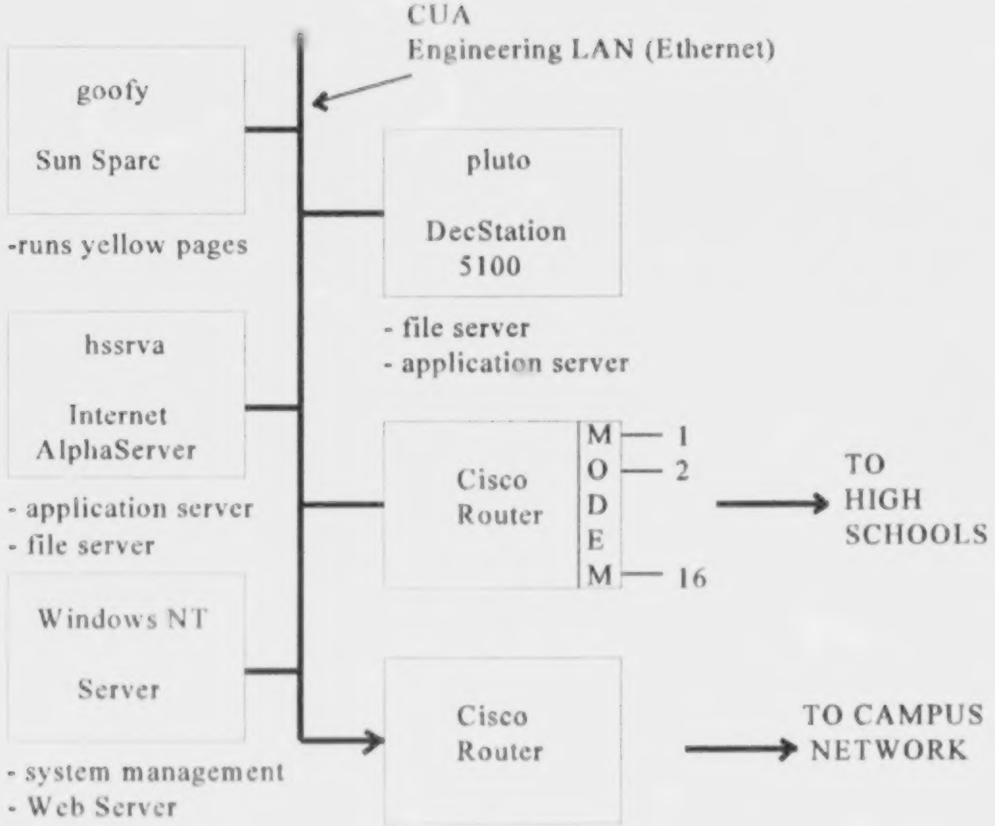
CUA
Engineering LAN (Ethernet)
goofy
Sun Sparc
-runs yellow pages
pluto
DecStation
5100
- file server
- application server
hssrva
Internet
AlphaServer
- application server
- file server
Cisco
Router
MODEM
1
2
16
TO
HIGH
SCHOOLS
Windows NT
Server
- system management
- Web Server
Cisco
Router
TO CAMPUS
NETWORK

Figure 1 Network Architecture

Achieving Self Sufficiency

The participating high schools typically could not have assumed the total operating costs from the outset of the project. Thus, a transitional funding plan, depicted in Figure 2, was proposed and accepted by NSF. In it, NSF pays 100% of the operating costs the first year for telephone line charges and the membership fees to the Internet provider. The second year, the participating high schools are expected to assume one-third of the operating costs. They assume two-thirds of the operating costs in the third year. It was expected that three years would be sufficient for the schools to plan and budget these operating costs. Further, the schools were advised to plan and budget for the replacement of the equipment necessary to support the connections within five years of its original installation. This approach represents an increasing commitment by the high schools each year. It is envisioned that as they realize the benefits of the new technology, there will be no reluctance in maintaining their resources as well as assuming the full cost.

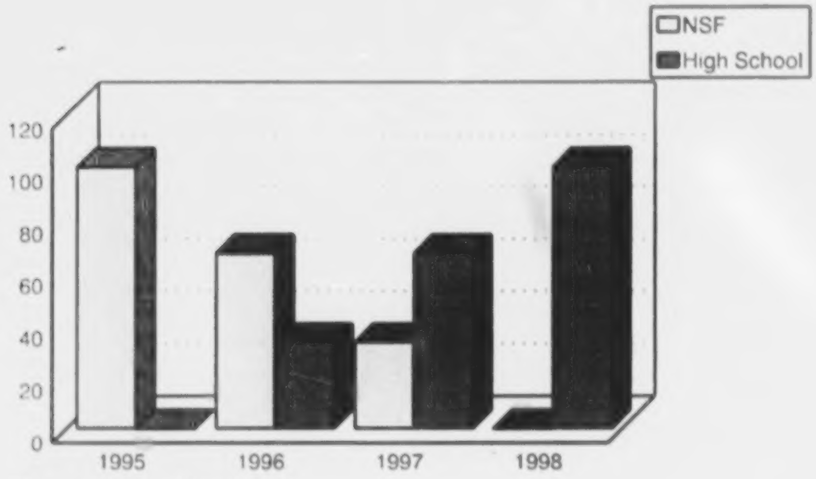

Figure 2 Cost Sharing

Training the Trainer

A key concept of this program, critical to the high schools obtaining self sufficiency, is to "train the trainer." A base of expertise must first be established at the high schools so that the tools available over the global Internet can be properly taught. A major investment must be made in "human capital" to ensure the success of this program. This is true for any initiative that relies on the participants keeping pace with technology.

Training is aimed at three target audiences: selected students, teachers, and network system administrators. A maximum of 15 students per session (two or three from each high school) are to be selected and given training on Internet resources at the introductory and advanced levels. These students will act as mentors and guides to other students at their high schools, assisting other students in discovering the Internet resources. All teachers involved at each of the high schools will be trained at both the basic and advanced level of Internet resources. A training course specifically geared to network administrators as an introduction to networking basics will be offered and open to the designated network administrators from each of the participating high schools

The students and teachers will attend hands-on workshops provided by BBN Planet Southeast's staff members. The workshops are 1) Introduction to the Internet for K-12 Teachers and Librarians, 2) Introduction to Internet Technology for K-12 staff, and 3) Introduction to Internet Technology for K-12 Students.

The training seminars are offered throughout the year. Training is available to new participants and to continuing participants who are connecting to network resources at a more advanced level.

Responsibilities

An Affiliation Agreement was developed to define the partnering inherent in The Connections Program and to help assure that the schools were aware of not only their opportunities but their responsibilities. In the Affiliation Agreement, the duties and responsibilities of the university and the high schools are defined. The document serves as a written memorandum of understanding so there will be no misunderstandings of expectations by either party. A sample copy of the Affiliation Agreement has been submitted to the CAUSE Exchange Library and is also available on the World Wide Web at: http://www.cua.edu/www/cc_acs/project.

Among the items included in the Affiliation Agreement are a statement of CUA's hours of operation and when staff will be available should assistance be required with a connection. CUA currently staffs its computer operations area from 8A.M. to 12A.M., Monday through Friday. There was concern that the high schools would have the expectation of coverage and support 24 hours a day, seven days a week.

The Agreement further defines what software the students are permitted to use. The university was particularly sensitive about this as many of its license agreements restrict usage of software to current students, faculty and staff. It also stipulates that students are expected to use the facilities at their schools. They are not entitled to use the facilities on the CUA campus without explicit permission or invitation.

Each high school is made aware that the Internet is a compendium of computers and networks world wide that are linked together electronically and that there is no person or organization that coordinates or manages the Internet. The majority of these materials would be considered scholarly works; however, pornographic and other materials deemed unlawful and unsuitable for anyone under 18 years of age are accessible over the Internet. The University cannot prevent a user from seeking out these materials. Although there is software commercially available that can "filter" unwanted material, it is certain that developers of unsuitable material will find ways to defeat these countermeasures. The Agreement states that the university will assume no responsibility for materials available on the Internet.

Acceptable Use Policies

An extremely important part of the Agreement from the university's perspective is that it spells out the high school's responsibility to educate students and their parents about responsible use of computers and networks. A sample statement of legal and ethical responsibilities is provided via the Affiliation Agreement to each high school participating in the program. There has recently been a flurry of activity in this area, as exemplified by numerous articles dedicated to this subject in the popular press. The schools are encouraged to tailor these materials or develop their own specific to their needs. Included is the suggestion that they obtain parental awareness of these issues for students participating in The Connections Program. One high school has already drafted a consent agreement that must be signed by each student *and* parent before access to the Internet via this project is permitted.

Summary/Conclusions

The Connections Program addresses a wide range of issues involving computer networking at the high schools. The implementation of the technology is an obvious consideration, but only one of many. The training being provided to designated high school teachers within the consortium on specific engineering software applications and on general knowledge and use of the Internet will hopefully work to enhance these benefits. Other equally important considerations are the investment of human capital, proper training, understanding the ethical issues involved in accessing the network, and a financial commitment to keep a modern networked computer facility--benefits obtained from the many partnerships inherent in this project.

The Connections Program is already promoting science and engineering in the secondary schools by extending the benefit of sophisticated computing resources to a larger number of schools and providing a much-needed educational tool. This project represents a modest beginning to what is a continuing effort in redefining the educational process in science and engineering. It is a given that use of these resources will soon extend to students and faculty in other disciplines.

The CWIS is Dead! Long Live the CWIN!

Cedric Bennett,
Director, Applications Support
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Abstract

This paper compares two models for delivering wide, easy information-access for members of our institutional communities and beyond. It contrasts between centrally managed and supported systems and distributed networks and services. It uses this comparison as a means to explore several interesting management challenges which the deployment of these technologies have created, many of which are still to be addressed.

Newer information technologies support, and even encourage, widespread information sharing. Relatively easy-to-use protocols plus easy-to-obtain client and server code ported to a wide variety of platforms has made publishing information campus-wide, and even world-wide, a simple matter for anyone with a network connection and the will. These new technologies are replacing the notion of the Campus Wide Information System (with its implied central control) with the much more managerially complex concept of a Campus Wide Information Network (CWIN).

The CWIS is Dead! Long Live the CWIN!

Cedric Bennett,
Director, Applications Support
Stanford University

Where did the CWIS come from?

Providing Information

During the 1980's, many institutions sought ways to use information technologies to electronically share information widely across their campuses. For the most part, these technologies involved maintaining central information stores on large centrally managed processors, creating a mechanism for navigating to and through the information, and making it available to students, faculty and staff via terminal access. Management and process infrastructures were created (often using existing structures) to support the growth and maintenance of these information stores.

The types of information provided via these means were of various types – central policies and procedures, library catalog and other bibliographic data, instruction and documentation regarding electronic services themselves. In addition, they often had one major characteristic in common; the information providers were most often central organizations supplying information to other central and de-central organizations as well as to individuals.

These systems met the goals initially set for them of providing information from central information providers to central and de-central information consumers. However, for the most part they were expensive to establish and to maintain. Only a relatively few institutions actually provided such services. These systems eventually became known as Campus Wide Information Systems (CWIS).

Exchanging Information

During the same time period, other information exchange technologies were also becoming more and more available. NetNews, Bulletin Boards, and List Serves were gaining in popularity, at least among the technical community. These mechanisms were designed more for the exchange of information across the network and between colleagues than just information providers supplying information to information consumers – they provided a means for dialog not usually present in the other model. These technologies remained relatively difficult to use and did not spread dramatically beyond the technology community.

What's a CWIN?

Newer CWIS Technologies

At the close of the 1980's, newer, network-based, desktop-centric, 'point-and-click' technologies began to appear. These newer technologies supported and even encouraged widespread information sharing. Gopher[1] and World Wide Web (WWW)[2] protocols plus easy-to-obtain client and server code ported to a wide variety of platforms have made publishing information campus-wide, and even world-wide, a simple matter for anyone with a network connection and the will. In fact, it has been the acceptance and deployment of these technologies which has lead to the term "Campus Wide Information System" (CWIS).

All of a sudden, the means to provide information widely was within the grasp of any institution. Although Gopher began as the preferred approach, it was overtaken within a very few years by the WWW protocol — primarily because it is a faster growing, 'richer' protocol and because clients were created early that supported all popular systems.[3] The rapid acceptance of the "Web" both in academia and in the commercial world has created opportunities and it has exposed (or exacerbated) problems.

Campus Wide Information Network (CWIN)

Since it is true that anyone with the will to do so, can create a presence on the Web and can link that presence to any other presence on the Web, it is no longer appropriate to think in terms of just a "system" (which includes an implied concept of control). The Web is not as controllable an environment as the initial concepts and implementations of the CWIS. It requires a shift in thinking to understand that older system-oriented management principles will not work in such a widely distributed and networked information environment. For many providers, especially those already used to the CWIS idea, there is discomfort in the notion that information can be made so readily available.

Management Issues

Seekers, Providers, and Managers

The information environment has three principle players;

- those who are seeking information
- those who are providing information
- those who manage the information technology infrastructure

These roles have always existed, but have not always been clearly delineated (because providers and managers were often the same people or organization). Of course, it is possible that any single person or organization can play any or all of these roles. It is important to understand the similarities and differences of each.

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[1] Originally developed at the University of Minnesota.

[2] Originally developed a CERN (The European Laboratory for Particle Physics in Switzerland).

[3] GUI clients, notably Mosaic from NCSA, were developed early for Unix, Windows, and Macintosh.

For seekers of information, it is important that the mechanisms for seeking be easy to use (especially for inexperienced seekers). It is also important that the mechanisms be fast and allow experienced seekers to get to the sought after information in very direct ways. It is very important to all seekers that the information, once found, be known to be authoritative.[4]

For providers of information, it is important that the information being shared is easy to find. It is also important that the information be easy to maintain directly by the provider and not through some intermediary (i.e., to change, to withdraw, to create). And it is important to most providers that the authority level of the information be clear and believable.

For managers, there are many concerns; here are a few:

Usage	Includes issues of living with the 'ad hoc' nature of the CWIN and satisfying the needs for authenticating the authority level of the information. It also includes server, network, and client performance issues.
Cost	The tradeoffs of using open, public protocols vs. proprietary approaches and the ability to fully utilize work already done by others (make vs. buy vs. share vs. assemble).
Stewardship	Who, at the institution, is responsible for "Home Page," the "look and feel' of the institutional pages, and the "protection" of the institution from inappropriate use (e.g., copyright compliance, what's official university information, unacceptable publication).
Support	Who provides Web services to others? How are users (both seekers and providers) supported?
Information Policies	What is the institution's electronic information policy? Who polices that policy?

Wrap up

The point of this article is simply to raise the idea that working with newer, network-based, information exchange technologies is going to require a new way of thinking and a new way of managing – perhaps best summed up in the phrase "managed anarchy." The notions and management principles that derive from a fully centralized systems point-of-view will not serve us well in this newer, distributed environment. That does not mean that we must give up all hope of management and even control of some aspects of the environment but only that it will require some additional thinking.

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[4] More accurately, it is important that the authority level of the found information be clear (even infofmation with little authority can be valuable – but its authority must be known.).

It is also useful to keep in mind that it is difficult to tell where this technology will eventually take us and what its impacts will be. We can be very sure that it will have an impact and that it will eventually be profound. It is much less certain just what those impacts will be.[5]

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[5] The National Highway System got its start when Congress asked General Pershing to organize a system of National Defense Highways (which led to the publication of the so-called "Pershing Map" in 1922). No one at the time was able to predict the eventual impact on our society of a National Highway System. It is just as unlikely that we, at this time, can predict the eventual impact on our society of a National Information Infrastructure ("Information Highway").

Secure Your Network in Ten Easy Steps

Roger Safian
Network Security Coordinator,
Northwestern University

Abstract

This paper provides an overview of ten important considerations as we ponder how to make our campus networks more secure. Readers will find ideas they can implement immediately to improve the security of their networks.

Computer networks have become valuable tools. We have gone from a few centrally managed resources to hundreds and thousands of machines on our local networks. Yet, the very ease and proliferation of computer resources have brought about new and unforeseen consequences. We've all heard the stories. We've read about the hackers and crackers.

The ten points discussed are: policies, network design, your vendor, your O.S., passwords, organization, openness, security officer, law enforcement, vigilance.

Paper Not Available

The 1990s Challenge of Insulating the Institution with 1980s Information Technology Policies

Susan Stager, Ph.D., Indiana University
Virginia Rezmierski, Ph.D., University of Michigan
Tad Pinkerton, Ph.D., University of Wisconsin

The following document is a snapshot of the current policy environment at universities and colleges, the issues that are arising and are being debated. Many universities that have put policies in place to guide community functioning, are reviewing those policies to ensure that they are sufficiently robust to meet the challenges of the fast expanding and changing technology. While review of old policies is going on, new policy areas are also being identified and analyzed. New issues arise, partly analyzed issues continue to be discussed, partly approved policies wind their way through processes, and old policies continue to be in need of review. All exist within campus communities at the same time. Some policy issues even become obsolete before they go to press.

The 1990s Challenge of Insulating the Institution with 1980s Information Technology Policies

Susan Stager, Ph.D., Indiana University
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Introduction

Rushed to the implementation stage in the 1980s, IT computer use and security policies may appear flat, stilted, and superficial. The principles upon which these policies were built are still keys ones, however, and the appropriate foundation for policies in the 1990s. What requires interpretation is such cosmetic phrases in these policies as "computing resources should be used in accordance with the high ethical standards of the university community." What does this and similar phrases mean in the 1990s?

As this paper is being written, we await the fate of the Cox-Wyden Amendment to the telecommunications deregulation bill. The amendment forbids the FCC from regulating Internet content. It also provides some liability protection for Internet service providers like colleges and universities if a good faith effort is made to prevent distribution of obscene material. This amendment symbolizes the moving target of legal and ethical solutions to problems encountered by colleges and universities as they provide Internet service to their campus community. One moment we think we have a clear reading on Congressional intent, the next moment a new amendment is introduced.

The following document is a snapshot of the current policy environment at universities and colleges, the issues that are arising and are being debated. Many universities that have put policies in place to guide community functioning, are reviewing those policies to ensure that they are sufficiently robust to meet the challenges of the fast expanding and changing technology. While review of old policies is going on, new policy areas are also being identified and analyzed. New issues arise, partly analyzed issues continue to be discussed, partly approved policies wind their way through processes, and old policies continue to be in need of review. All exist within campus communities at the same time. Some policy issues even become obsolete before they go to press.

I. Historical--Yet Still Around--Policy Issues

There are policy issues that we have faced in the past which continue to need attention on university and college campuses. The following section identifies some of those issues.

A. Harassment

The populations of universities and colleges are made up of a high percentage of young adults. Many are experimenting with and/or refining new ways of communicating with their peers and with others. Technological changes cause all of us, regardless of age, to learn new ways of using the technology to get our messages across to others. In this fast changing arena we all respond at times without thinking carefully about the impact of our words. We all struggle with how to enhance our messages with the nonverbal cues that we use so readily in our face-to-face communications. We all need to be aware of, and responsive to, the personal boundaries of others and when and how we may violate those boundaries during communication.

Harassment, insults, hurtful, insensitive language, are all found in everyday communication. What is new, is the speed with which we can pass such forms of language to many individuals, and do so with anonymity in some cases. What are the new forms of problematic communication that we see on campuses as information technology is used? What constitutes civil communication? When and how are boundaries crossed in interpersonal communications? When is a message a harassment? All of these issues need to be examined and community values regarding interpersonal communication strengthened on a continual basis within university and college communities.

B. Pornography

IT policy makers still struggle with the question of what is pornographic. Community standards within the ivory tower differ from those without. IT policy makers should watch other media -- newspapers, film, video, cable, TV -- for trends. For example, a recent issue of EDUCOM Review reports that Time Warner Cable wants to "scramble" sexually explicit programs on its New York community access channel, and make subscribers request programs in writing. The ACLU has charged "censorship." Time Warner countered that it has the same right to control what it sends across the wires as the newspaper has to control what it prints. What control does IT have over its wires?

C. Copyright

Many students come from an environment in which copying music and videos is the norm. Many students believe that they are 'authorized' to copy any material that they require for their academic work. They equate student status with a special class of citizenry that can use information resources without cost.

The typical computer use policy contains a catch-all phrase with wording like the following: "Computing resources may not be used for illegal purposes. Examples of illegal purposes include: Unauthorized copying of copyrighted material." The student is no wiser after reading the statement than before.

The copyright issue is no less murky from within the walls of the computer center than outside. Copyright laws may protect program text, but it does not protect industrial design elements of the programs, such as command hierarchy in the Lotus v. Borland, case or the internal interfaces involved in the Altai v. Computer Associates case. (Communications of the ACM 1995) Copyright issues will continue to need attention and study.

D. E-Mail Privacy

Electronic communications are sweeping the campuses as the primary use of the technology. Electronic mail is used for interpersonal social communications, for the scheduling of meetings, for informal discussions of topics between staff, for discussion of highly sensitive and personal topics, for generally open and free discussions of public topics, and for decision-making at some levels. Most disturbing is the fact that like most forms of communication there is a mix of several of the above content types within many messages. Individuals use the tool to accomplish a number of objectives at one time.

Some of the communications that travel across electronic mail are strictly business related; many are not. Some institutions have provided electronic communication tools explicitly for the purpose of increasing open communication and discussion, for increasing the exercise of Freedom of Speech, for creation and play with ideas, and for increasing the intimacy of groups. Some have provided electronic communication tools explicitly, and perhaps solely, for business functions.

The law is unclear as to the privacy of electronic communications. Should universities and colleges monitor the use employees make of electronic mail? If someone complains about a message received by an employee, does the employer have the obligation, the right, to intercept and read communications? As we keep records of the amount of use of systems like electronic mail, is there information in those logs that could be analyzed to identify the amount of time individuals spend in use of e-mail or even the specific individuals with whom they communicates?

II. Current Policy Issues Gaining More Attention

A. Social Security Numbers as Common Identifiers In this section we identify those issues which are currently being debated because they have taken new form through the use of technology.

Periodically, the issue of a single card/number which will identify individuals, a common identifier, arises. Over the years, often from the initiation of an effort such as in the case of social security numbers, leaders initiating the effort have insisted that the number will not be used for purposes other than that originally intended. However, in each case, once established, the number/device becomes embedded and found to be useful for many other purposes; it is readily adapted and reused.

Will universities and colleges face legal action from those who wish to protect their financial and other personal information, as uses of social security number continues to proliferate? Will a unique number be used on college campuses, one that is not tied so directly to personal financial and credit information? Or will the increasing use of debit cards on the campuses cause the use of identification cards, cards tied to social security number and other personal information, to expand well beyond what is currently imagined? Will the momentum and ease of the technological applications using these common numbers, overshadow the privacy concerns in the use of common identifiers?

B. Liability for E-mail Campus Directories v. Paper Campus Directories

Suffice it to say that many universities now have a process in place whereby a student, faculty, or staff member may have an "unlisted" e-mail address, comparable to an unlisted telephone number. Are campuses giving individuals choices in this regard? Are they allowing privacy in large national and international arenas, but public information in local arenas if that is desired by the student, staff, or faculty member? Or are system applications designed in such a way as to be automated without user choice, or to be inflexible to different needs at different levels of information dissemination? What are the liabilities as we handle this type of personal information--directory information?

C. E-mail Stalking

The crime of stalking received national attention several years ago because of a few celebrated cases, especially that of David Letterman. The crime of stalking has found new expression on the campus network. One university has had a case in which the activity of a computing-intensive female student was monitored by a male via VMS software listing the terminal of logged-on users. No physical contact was made between the stalker and the female, a condition of most stalker statutes currently enforced. But the motivation of the individual was the same as that of the traditional stalker, and the police acted.

D. E-mail Bombs--Box Stuffing

Minimal programming skills are necessary to create a program that will generate enough junk mail to flood a mail box and shut it down. Is it a form of harassment, a harmless prank, an act of vandalism, a problem with impulse control, an educational problem, or a serious threat to system security that one user can close down access, for another, purposefully? What does the university or college say to users about equity of access, about reliability of access? What is university responsibility in this regard?

E. E-mail As the Core of Lawsuits

Thanks to Newsweek, Time, and other popular media, the public now recognizes that a deleted mail message isn't necessarily an unrecoverable piece of evidence. The critical piece of evidence in a lawsuit may be an e-mail message retrieved by a university staff member from a server or back-up tape. The absence of a message on a back-up tape can be just as useful to a case.

In the commercial world, computer system detectives are hired to search for discarded files and messages, or even reformatted hard disks. To what lengths should computer center staff go to retrieve data to assist university legal counsel or local law enforcement officials? How much staff time should be devoted to the task? What should users be told about back-up files and other storage media? What is available under the Freedom of Information Act, even if it is not sought through court order? Can we maintain electronic mail privacy for users? How important is it?

F. Political Activism Using the Campus Computer Resources

At one university, the fine line between politics and Free Speech on the campus network first became apparent when the electoral board fined one of the student political parties for using e-mail communications during the student presidential race. The next volley was fired during the city/county elections when a faculty used a distribution list to send an endorsement of candidates to his friends on campus. The next step was a request from a state representative to have a home page on the University system. Each step of the way there was debate about the proper role of the University.

Another form of political activism that may affect universities is of the "Tiannamein Square" variety. Students may involve the computer network in their struggles with administrators. While in the 1970s students brought universities to their knees by flushing all of the dorm toilets simultaneously, students could easily bring the campus computer system to its knees as well. When 4,000 people attempted to log into Goodard Space Flight Center to see comet Shoemaker-Levy hit Jupiter in 1994, the system, designed for 30 simultaneous users, crashed. Campuses are already feeling the strain of scaling up to the number of simultaneous users that want to use the increasingly popular tools. Campus networks can crash with, or without, a political motivation.

III. Emerging Policy and Debate Issues

New issues arise almost daily as technology is being applied in new and modified ways. The issues identified in this section are just beginning to be debated on university and college campuses. Few policies are in place to guide communities in these areas as yet.

A. Digital Signatures

In the not-too-distant future, we will be amazed that we ever debated the validity of on-line signatures. In the Middle Ages it was necessary that heated wax, in the form of a symbol, be affixed to a document. The symbol might be the family seal embellished with mottoes. Today, our legal system finds that a promise can be binding without a written signature. Those of us who have performed the bulk of our work electronically for some years now, daily use our plain-text ASCII name in the e-mail "from" line as a symbol of our promise. And as time passes, we are more and more comfortable handling major business transactions with digital signatures. This society long ago dispensed with the seal as a sign that a promise would be enforced. Are we building adequate devices to ensure that a signature is what we believe it to be, and made by whom we expect?

B. Racial Electronic Terrorism

In October of 1994 someone broke into the computer account of a Texas professor and sent racist messages to about 20,000 computer users in four states. In response, about 500 users sent the professor death threats and other harsh responses.

Messages, felt to be racist or otherwise threatening and obnoxious, can be sent, responded to, forwarded, and many times duplicated without ever confirming the source of the original message, without identifying the actual sender. What is the role of education on campuses in these matters? What do we need to do to develop systems that help individuals confirm identities of senders of messages, or at least understand when forged mail is received? What role, if any, do universities and colleges have in protecting their users from such acts of indirect terrorism?

C. Commercial Ventures on the Internet

With over 700 electronic malls and specialty stores on the Internet, all accessible from your campus computing network, it is difficult to enforce a campus policy of "no commercial use of the campus network." What is the purpose for which the campus network was created? Is it important to justify the use of the funds and try to restrict the commercial use of the network? Is expansion of the use of the campus network to non-affiliated users a natural, extension of service, solely driven by the potential of a new source of funds, or a needed extension of service to wider communities? Or is it a misuse of funds and an inappropriate intrusion into the life of the campus?

D. Authoritative Source for On-line Documents

With the immense popularity of the World Wide Web, and the desire of so many users to display documents in that environment, a significant question regarding representation comes into focus. What documents on the WWW represent the University? How does an institution confirm the validity and integrity of documents that purport to represent the University? What is the authoritative source for information? How does the institution organize and manage the input and updating of significant documents that represent their campus?

E. Institutional Records in the Electronic Environment

As administrators, faculty, and staff of universities and colleges create more and more documents within the electronic environment, and store them in different forms, identifying and preserving records becomes an important policy consideration. Who creates records? In what format or medium should records be created? If they are contained within electronic communications, how can record and non-record content be separated? How can the institution guarantee that documents that are created electronically, and perhaps stored electronically, will be available one year from now when, perhaps, systems are changed and information is transferred from place to place? How will the institution guarantee that the documents will be readable one year from now when, perhaps, the tools have been upgraded or discontinued? What should the operational policy be within universities and colleges to ensure the creation, maintenance, and preservation of university records?

F. Handling of Personal Information

We are now able to pass information around the electronic environment of our institutions with increasing ease. Everyday it becomes easier to cross over the barriers caused by different technological platforms, and pass documents from one user to another. Administrators at many universities and colleges are talking about sending data between institutions over the networks. As each college and university faces these new potentials, they will need to examine the current and future practices when it comes to the handling of the personal information of members of their communities.

What is personal information? Is the newly digitized signature of an individual user the property of the University or of the individual? Can it be used in one or more ways? Did the individual understand the ramifications of giving that signature to be digitized? What about photographs? How can they be used by institutions? Do individuals understand the ways in which the University intends to use the photograph at the time that it is taken? Does the University even understand its own intent as it asks for this personal information? What will the universities and colleges do as they consider the possibility of transporting student grades, transcripts and other information between institutions? What policies will guide these decisions?

G. Image Alteration

Images are now possible to alter digitally without a trace. Photographs can so easily be changed that their use in court is being diminished. Soon we will be able to alter active video as well. What ramifications will this ability to alter images have on the campuses? Will altered images of a President of a University, for instance, be seen as Freedom of Expression or as character assassination? Will placing an individual in a scene falsely and publishing that picture be understood as misrepresentation, or artistic creativity? What are the policies and guidelines that will be needed to protect against impulsive administrative actions, and what will be needed to protect essential Liberties?

H. Libel Revisited

Colleges and universities remain uncertain as to their vulnerability for postings by students. An agreement was reached this month between the law firms representing Prodigy on-line services and Stratton Oakmont. Stratton Oakmont, an investment firm, felt it had been libeled on Prodigy when a user posted a message accusing the firm of "criminal fraud." In the agreement, Prodigy would not be held libel.

Hopefully this court decision will be generalized and put an end to concern that the university will be held responsible for postings on its computer network. In a sense, this court decision grants the computing network the same status as the telephone network in that telephone companies cannot be sued for libelous calls made on its lines.

IV. Enduring Principles in Current Policies

While the issues are complex and ever-arising, there are some enduring principles which seem to be repeated as we continue to debate old issues, participate in the current discussions, and examine the new emerging issues. These principles help to clarify issues as belonging to various continuation of values on campuses. Once we are able to identify what the issues are really about, it becomes easier to accomplish the values clarification work that must be part of any policy development process. Below are some of the enduring principles.

A. Distinguishing Between Private v. Public Information

The debate between public vs private information is being played out at all levels. Historically, many documents have been made available to the public at selected sites, such as libraries, requiring the public to come to that site in order to access the documents. With the growth of the superhighway, at the state and federal government levels, statutes, administrative codes, and the text of bills being considered by the legislature (including the bill's status and what its fiscal impact would be) are being made available over the Internet. Some states, such as New York, sell the information to provide another revenue source for government. California is on the other end of the spectrum, making the information available at no charge to anyone who wants it.

At the University level, debate reigns about what is public and what is private information. State and federal statutes take some of the guess work away. However, there is still a gray area. To further complicate the matter, statutes often use the terminology that public documents must be made 'accessible' to citizens. What does 'accessible' mean in the age of the Internet? Distinguishing between public and private information is a principle that will assist policy development.

B. Distinguishing Between Security and Ease of Use

The gap is widening between security on administrative computing systems and academic computing systems. At the same university, administrators may be required to transgress through three levels of passwords to acquire a database that is ultimately part of the same campus network used by students who routinely share their password with friends. Distinguishing between areas requiring security and those requiring ease of use is a principle that will benefit policy makers.

C. Distinguishing Between Institutional and Individual Ownership

The copyright laws are currently under revision, leaving the University in limbo on these critical issues. The complexity of copyright increases in the multimedia environment. The person who created the original work owns the copyright. Accordingly, the text might belong to the professor and the image might belong to the graphic artist. Yet in may institutions, the University owns the copyright for both because it employs both the professor and the graphic artist. Distinguishing between institutional and individual ownership in policy will provide guidance for communities.

D. Distinguishing Between Social Responsibility and Experimentation

Universities and colleges have a large investment in allowing free experimentation and creative expression on their campuses. Freedom of Speech is an imperative if we are to meet our missions of teaching, learning, and the creation of knowledge. But where does experimentation end and social harm begin? In this new electronic environment, how do we clarify the limits and boundaries of these concepts? Distinguishing between responsibility and experimentation and the limits of each, is an important principle for both policy making and for education.

Conclusion

The members of this panel have years of experience at their respective universities in contemplating the issues surrounding the use of information technology. They do not claim to have the answers to all of the questions raised in this paper or to those that will be raised during the panel presentation. However, they will share their thinking and the guiding principles that have helped them to cope with new issues. They will share advice as to how to deal with this exciting time for policy makers. They will look at 1990s challenges and the robustness of the 1980s policies that they have helped to create.

REINVENTING THE WHEEL:
Sometimes It's the Right Thing

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ABSTRACT

This paper provides a detailed description of how Dallas Baptist University has used the impetus generated from implementing a new integrated campus administrative computer system to document, analyze, and recommend significant organizational changes. The changes were undertaken to improve overall campus efficiency and quality of service. The basis of the paper is the methods by which DBU reengineered major service processes on a campuswide scale. Illustrative examples include reengineered processes that were improved by as much as 200 percent.

In addition to discussion of the reengineering process, attention is drawn to actual case examples, documentation, and recommendations. Also addressed is the political skirmishes involved in the reengineering efforts, along with the techniques for overcoming resistance to the recommended restructuring.

The entire presentation has been created to help move reengineering efforts from a pie-in-the-sky conceptual plane to a truly practical, applicable level. The increased competition, shrinking budgets, and technological pressures of today's educational environment assure that this topic will be appropriate for some time to come.

"There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things."

-- Niccolo Machiavelli, 1532

In the beginning, there were the Dark Ages. The technological infrastructure was formless and void, and Computing Services brooded over the chaos. The creators of the chaos were many and powerful. Fragmentation and replication of effort ruled individual departments. In an attempt to stem the tide, quasi-functional homegrown administrative software applications were poorly designed, poorly developed, poorly implemented, and were now impossible to maintain. Integration among the various software entities was sporadic, unworthy of trust, and a fond wish for the future. The two primary native populations -- faculty and administration - had founded the entire race relations on the foundation of noncommunication and mutual distrust.

While somewhat frivolous, the fictional account above includes far too many elements of truth. Dallas Baptist University had found itself on the horns of the same dilemma facing all institutions of higher education today -- how do we continue to provide a quality service and product to our students in the face of shrinking resources?

Dallas Baptist is a four-year liberal arts institution offering multiple degrees to the Master's level. We have an FTE of approximately 1,800 and a total enrollment of 3,100. However, unlike many institutions, nontraditional adults comprise a majority (53%) of our student population. The institution has found great success in partnering with working adults to allow them to complete a college degree either through our traditional undergrad programs or our experiential learning College of Adult Education. For students wishing to complete a graduate degree, we have partnership programs with many large corporations in the Dallas area including MCI, GTE, General Motors, and others to bring our educational resources to their sites. With several companies we have created lock-step MBA programs where groups of students are taken through our MBA program in a highly regimented, step-by-step curriculum from beginning to end. We have made great efforts to tailor our program to our demanding students' needs.

However, the implementation and effective continuation of such programs requires an incredible amount of flexibility and oversight, from faculty, staff, and administrative software systems. As time progressed and demands on our computing infrastructure increased, it became glaringly apparent the list of identified dysfunctionalities was growing rapidly, and the tools we had in place were failing to support our day-to-day business requirements, and were hopelessly unsuitable to support future growth strategies.

After upgrading the physical infrastructure of the campus computing environment, the next issues to address were the fragmented administrative software systems and the resulting lack of communication and information sharing. The first step on this endeavor was documenting the users' needs. To accomplish this, the Computing Services department, teamed with an external consultant, scheduled an entire week of one- and two-hour meetings with user departments. The agenda of these meetings was not only to document requirements for daily operations, but for the user communities to generate a 'wish list' of what would ideally aid them in their functions and the ultimate strategic goals of the University.

The information gleaned from this series of meetings was used to create a Request for Proposal (RFP) sent to 33 administrative software vendors. Of the 33, we received only nine legitimate responses. When the candidates were scored and weighted against the criteria outlined in the RFP, the Datatel Colleague and Benefactor systems emerged with the best scoring.

Implementation

The implementation process began with several basic assumptions. These assumptions were held as basic parameters for the entire process and directed all activities. The assumptions were:

There would be no significant alterations or enhancements to the original purchased system until at least one year of operations. The Datatel system was installed and initially implemented in a 'vanilla' fashion. This forced the departments to carefully review their current work processes thoroughly and jettison the unnecessary, unwanted, and inefficient. The primary goal of this directive was to disallow the corruption of the software to enable the current dysfunctional administrative processes.

All implementation activities would be governed by four cross-functional teams. (Appendix A) All significant operational decisions would be reviewed by team consent, with disputes to be arbitrated by the primary implementation team. The goal of this approach was twofold: first, we would be able to leverage the knowledge of many individuals. We felt this necessary in a system implementation of this scope. Secondly, each person involved in the implementation teams acquired a sense of ownership in the entire process, and expended the efforts necessary to ensure a successful conversion.

The existence of any 'sacred cows' would not be recognized. Every process of every department was to be documented and thoroughly analyzed by the appropriate team. Each member of each team had the authority to ask 'Why?' and any point and to challenge the inclusion of any part of any process. If the reason of existence for that activity or process could not be proven to the satisfaction of the team, it was slated for discontinuance.

Analysis Process

Teams documented each process utilizing various business process reengineering tools including process flow charting, time cycle analysis, activity-based costing, and Pareto analyses. The flow charts allowed all participating team members to graphically follow the flow and decision-making activities involved in a process and proved invaluable in identifying 'widows and orphans', or activities that led nowhere and added no value to the process as a whole. Time-cycle analysis and activity-based costing gave the ability to produce 'what-if' scenarios with each process. We answered may questions of "If we cut out this step, what effect would it have on the total time and/or cost of the entire process?" "If we could make this activity more efficient and save this much time, how much money could be saved?" It was only through answering these type of questions that a truly successful system migration could be achieved. It is only through examining each business process in light of the overall institutional strategic directions that the administrative platform for the future may be built.

The natural result of this intensive self-examination was the formulation of 'ideal' process maps. We constructed these ideal business processes with no regard to perceived constraints. We found that only through the denial of any barriers to progress may the most progress be realized. The goal processes were then documented and quantified for presentation to and persuasion of senior administrative decision makers, again utilizing the graphical tools described above. Examples of these charts and graphs are in **Appendix A**.

The New Era Begins

Upon nearing the end of the justification and politicking stage, the team began to realize results from our efforts. In several cases, departmental responsibilities were reassigned to those areas most suited to the tasks. Personnel were relocated to departments directly related to their actual job functions. Departmental reporting responsibilities were given to identified owners of the data in the user community. Graduation responsibilities evolved from a tri-departmental exercise in chaos to one department and one designated supervisor with ultimate responsibility. However, many bloody battles were fought to achieve these gains – some lost, some won. Listed below are some of the victories I felt we achieved, as well as the primary contributing factors to that success.

Class Scheduling

- Process steps were reduced from 31 to 15
- Process cycle time dropped from 42 days to 17-20 days
- Accuracy of communicated information rose dramatically

Factors of success: integration of Colleague software, real-time updating of student files

Student Registration

Registration completion time fell from approx. 90 minutes to approx. 35 minutes

Factors of success: flatter learning curve of Colleague system from standardized screens and functions throughout all Student System modules. This allows more personnel to be cross-trained on multiple process functions.

Institutional Reporting

Captures approximately 20% more institutional reporting and student retention data

Factors of success: integration of all Student System modules from Admissions Prospects to Graduation Processor, extensive student demographics data collection capabilities, and very extensive ad hoc query capabilities

Decentralized Purchasing

Shifted responsibility of budget management to proper points of user responsibility, giving designated departmental budget officers accountability, control of all departmental funds, and detailed analysis and reporting tools

Factor of success: highly developed budgeting system relying of a budget responsibility tree with adequate internal security and allocation controls

Reduced Workloads

Check request percentages of total expense report submissions fell from approximately 95% of all purchasing traffic to less than 20%. This allowed each purchasing officer to reclaim 12 hours per week, with each senior budget officer reclaiming 3-5 hours per week.

Factors of success: again, capabilities of budgeting system allowing pre-authorized purchasing levels for budget officers, tracking of account encumbrances, and detailed reporting capabilities

Qualitative Benefits

- Greater trust and teamwork generated between administrators, staff, and faculty
- An infinitely greater level of communication between all administrative departments and key personnel

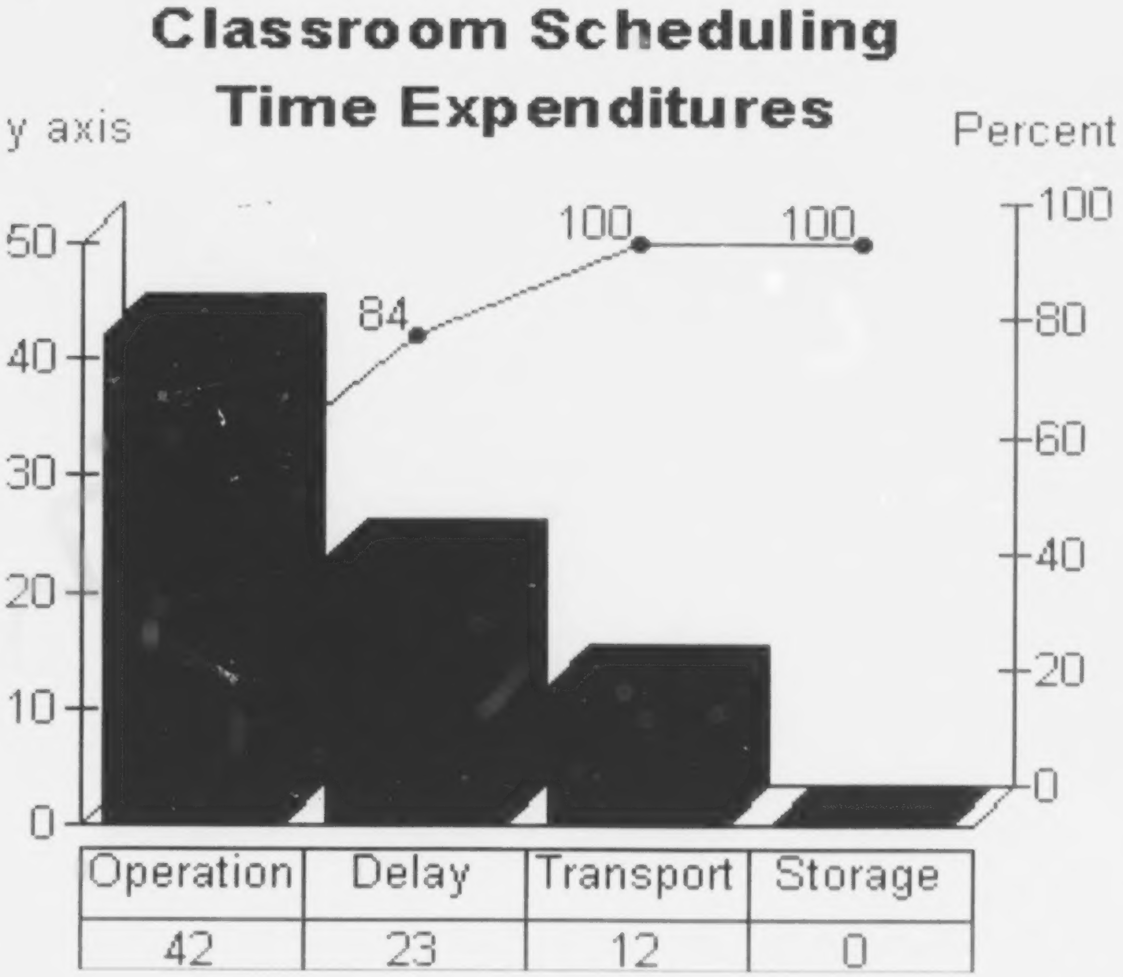
Factors of success: the teamwork approach used in the implementation process

The entire implementation process, while probably never labeled complete, is a success in any estimation. The benefits derived from taking a truly team-oriented approach to product selection and implementation will never be lost. As long as this administrative system, both software and people, functions, continued progress toward the institutional strategic goals is possible. The only barriers to continued advancement are ourselves, for the tools and infrastructure are there to be built upon.

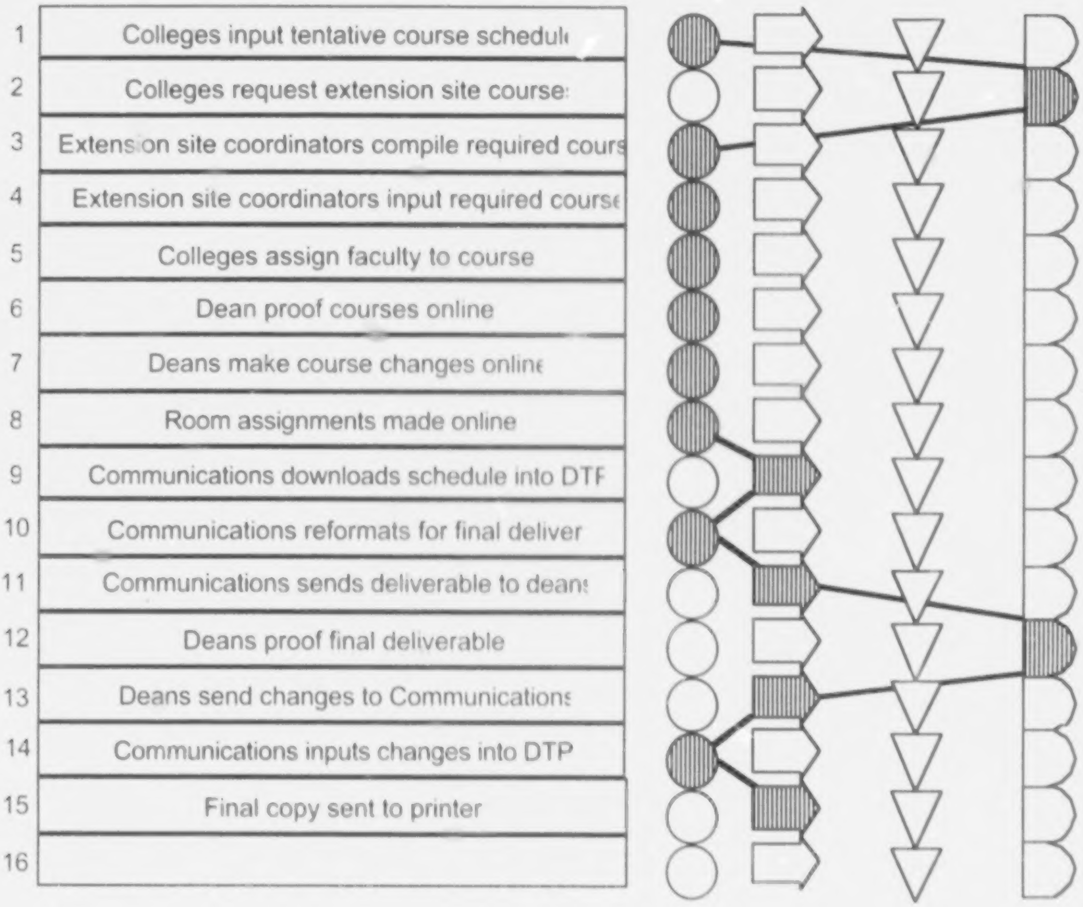
> **"We trained hard... but it seemed that every time we were beginning to form into teams we would be reorganized... I was to learn later in left that we tend to meet any new situation by reorganization... and a wonderful method it can be for creating the illusion of progress while producing confusion, inefficiency, and demoralization."**
>
> **-- Petronious Arbitor, 210 B.C.**

APPENDIX A

PARETO CHART EXAMPLE



PROCESS STEP CHART EXAMPLE - CLASSROOM SCHEDULING PROCESS



1 Colleges input tentative course schedul
2 Colleges request extension site course
3 Extension site coordinators compile required cours
4 Extension site coordinators input required cours
5 Colleges assign faculty to course
6 Dean proof courses online
7 Deans make course changes onlin
8 Room assignments made online
9 Communications downloads schedule into DTF
10 Communications reformats for final deliver
11 Communications sends deliverable to dean
12 Deans proof final deliverable
13 Deans send changes to Communications
14 Communications inputs changes into DTP
15 Final copy sent to printer
16

Computer Security

Questions to Ask ....
Questions that Need Answers

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Current technology is putting information and computing into everyone's hands. Even Elementary school students are getting access to the Internet and surfing the net as soon as they develop reading skills. But can or should everything be available to everyone? Of course, the answer is "NO". Can it be secured in the current environment? That depends on your definition of "secured".

This paper looks at the information and services higher education institutions typically deal with and identifies the risks and exposures the current computing environment presents.

Introduction

Higher education is facing more competition, more discriminating customers, and less money. Controlling for every possible risk/exposure is not feasible and not in the best interest of our institutions. What is more important is that the risks and exposures are studied by the technical people and that the costs and benefits of eliminating the risks and exposures are presented to the institution's management and strategic planners for a decision on acceptable risk. Risks and exposures vary depending on the data (staff salary vs. student grades), the business application (writing payroll checks vs. admitting students), the computing environment (mainframe vs. client server), and communications (manual vs. electronic). In some cases, the law defines the security need. In other cases, it is a matter of politics and public relations. Sometimes it is even a matter of competitive advantage in an ever increasing competitive market. Security is not absolute. The best defense is knowing what your institution's risks and exposures are, how to minimize them, and which exposures you are willing to live with.

Computer Security means protecting a computer system against internal failure, human error, attack, and natural catastrophe. The goal is to prevent improper disclosure, modification, or destruction of information or deny service through the use of technological safeguards and managerial procedures. Security and control are a part of the entire computing environment. Security must utilize resources effectively and simultaneously minimize unnecessary interference with business goals, competitive performance, and the user's utility.

Security is a trade-off. The institution's managers and strategic planners must weigh total control and its costs/benefits against an acceptable level of risk. The institution's technical, business, legal and audit professionals can provide information to help management come to an informed decision.

Trends Increasing Risks

The following computing trends are presenting our institutions with incredible opportunities, but at the same time are increasing risks resulting in costly exposures.

The *decentralization* of hardware, software, data, computing personnel, and even technological decision making is evident in most organizations. With this, most organizations face a multiplicity of platforms and software. There is more to control, more to know, and in some cases it is hard to know what or where it is. There are users creating adhoc reports without controls resulting in duplication of effort and unreliable reports. The increased chance of misapplication of technical control features or lack of controls support by users increases the potential for operating errors and mistakes.

Microcomputing has become commonplace. Originally, microcomputers were used mostly to complement mainframe processing, i.e. a downloaded spreadsheet enabling further data manipulation. Now it is often the platform of choice for institutionally important processing. Unfortunately, the microcomputer environment is still far less secure and standards such as disaster recovery and software change procedures are not as diligently followed as its mainframe predecessor.

Communication and the Internet have revolutionized computing by *opening up access* to the world. Many of our institutions are connected to the Internet. There is more and more reliance upon this information and the communication vehicles computers provide. Many of us base decisions on information we obtained from listservers, bulletin boards, and electronic colleagues (E-mail).

More and more business authorizations and approvals are being conducted entirely over electronic media. Often signatures are only an electronic identifier stored in a data file. *Electronic approvals* are fast, easy and efficient, but to prevent fraud and to stand-up to auditor scrutiny proper controls are imperative.

Many institutions are *outsourcing* some or all of their computing. Many institutions have discontinued in-house systems development in favor of purchased system software. This can give the institution a false sense of security. Even though it is a vendor package your institution is still responsible to ensure that the system has proper controls and is properly implemented within your institution. Most outsource companies and some software package vendors have had their product/service audited. They should be able to provide you with a SAS-70 document citing control weaknesses.

The *technology is changing fast*.. Often with a new technology the security controls come later. In addition to a lack of security mechanisms, there are exposures created when staff are poorly trained and not equipped to properly implement or use the product.

Students, our single largest customer, grew-up with this technology and are comfortable with it. They are also very entrepreneurial and actively explore ways to exploit the technology made available to them. It is important that they understand the responsibilities that go along with the use of those resources.

Finally, many institutions are faced with *decreasing funds* and are *downsizing* their operations, particularly their administrative staff. Technology is being looked at to provide the means to accomplish the teaching and research missions of our institutions with less. Segregation of duties will not be possible as a control point, and computers will be relied upon to replace some of the current manual checks and balances. There will also be less IT staff. The industry standard for workstation support is recommended at 1 staff to 50 workstations. At Cornell that number varies from 1:100 to 1:200. Short-cuts are taken. Security administration, and LAN and workstation monitoring suffers. With downsizing and budget cuts comes a decrease in commitment to maintenance, system upgrades, and controls. Doing more with less often results in bypassing controls and security measures to get more work done.

Security , Controls, and Exposures

What needs protecting and why? Data needs protecting. Some data is protected by law. Our institutions have a responsibility due to 1) State/Federal/Agency Regulations and Requirements and 2) Laws protecting individuals such as FERPA, Privacy, and Labor laws. Compliance with regulations is increasingly important with research moneys becoming more scarce and indirect cost rates being scrutinized. Accounting and Human Resource information needs protection from fraudulent tampering. In other cases, security may be politically desirable.

Software Applications must be well controlled to ensure the institution's computer systems provide reliable information. Hardware, System Software, and data are valuable assets that must be secured and controlled to prevent tampering and guarantee continuing operations.

Finally, there is the misuse of the computing resources themselves. It may be the abuse of the institution's E-mail system or the setting up of a commercial web page on your university's network.

Exposures come in many forms and all can result in loss or harm to the institution. Erroneous recordkeeping, unmaintainable applications, or business interruptions can compromise the integrity of data. With decentralization and the move to smaller, more portable platforms, finding what needs protecting and determining whether there are sufficient controls is becoming more difficult. The key is to identify mission critical operations and the computing they use. Proper controls reduce institutional inefficiencies that would exist if for no other reason than the cost and time that goes into fraud investigations or dealing with a political/public relations problem.

The penalties include:

1) Adverse publicity or loss of reputation,
2) Disruption of service,
3) Downtime: delay: interim operation: recovery,
4) Fraud or embezzlement,
5) Future business or funding losses,
6) Investigations,
7) Litigation,
8) Loss of confidentiality,
9) Loss of goods,
10) Loss of money,
11) Loss of opportunities,
12) Loss of system integrity,
13) Misuse of resources, and
14) Staff disciplinary action.

Where is the Threat Coming From? Children are curious about using the computers...often they come into our university networks using their parents' or a friends' network logon. Hackers break in for the intellectual stimulation or the fun of it. Sometimes they find a logon without a password or one that has an easy password to guess. Enterprising students see the use (abuse) of the computer and network resources as their right simply because they are students at our institutions. Disgruntled employees are a possibility, but usually employee's are just using university resources for their own personal uses. What enables the abuse to occur is sloppy security administration, insufficient computing use and acquisition guidelines or methodology, insufficient or poorly communicated university policies, and insufficient controls over resources. Interestingly enough, hackers are not the number one threat.

Information Security Threats ***	
Accidents and Errors	55%
Employee Dishonesty	15%
Fire, Flood, Earthquakes, Natural Disasters	15%
Employee Revenge	10%
Hackers	5%

***Commitment to Security, The Second Statistical Report of the National Center for Computer Crime Data (Santa Cruz, CA: National Center for Computer Crime Data, 1989)

Risks and A Sample Risk Analysis

Risk is the probability that a particular threat will exploit a particular vulnerability of the system. A *risk analysis* is a formal examination of an organization's information resources, controls, and vulnerabilities in both manual and automated systems. A *risk* *assessment* identifies and evaluates the types of risks, their probability of occurrence, and their potential adverse impact for an automated information system.

The goal is to manage the risk by identifying, controlling, and eliminating or minimizing uncertain events that may affect system resources. It includes risk analysis, cost-benefit analysis, and an overall system security review as well as the selection, implementation, testing and evaluation of safeguards. The result should be the institution operating at a level of risk they are comfortable with, an acceptable risk. Management's acceptance of a level of risk must be based on empirical data and supportive technical opinion that the overall risk is understood and that the controls placed on the asset or environment will lower the potential for loss.

Recently Cornell implemented two applications: Employee Essentials (A human resource inquiry client server application) and Faculty Advisor which was made available through the web. Security and control is relative. Cornell does not run encrypted communications, so for years mainframe passwords have been flying unprotected across our network. Consequently, the use of client server and web technologies coupled with Kerberos or Sidecar, a ticket granting application for authorization and authentication (developed at Cornell) though not full-proof is an improvement. What is desirable when any new technology is introduced is a technical identification of the exposures and then for the technical, the auditing, the legal, and the business minds of an institution to identify the risks. Armed with the information, the leaders of the institution must decide whether the risks are worth it.

Risks are the potential for loss, best expressed as the answer to four questions:

* What could happen? (What is the threat?)
* How bad could it be? (What is the consequence?)
* How often might it happen? (What is the frequency?)
* How certain are the answers to the first three questions? (What is the degree of confidence?)

What follows is an excerpt from a risk analysis performed by Cornell Information Technology and Internal Audit for the Faculty Advisor Application recently put into production at Cornell.

Point of Exposures for Faculty Advisor

The key control points for client/server applications at Cornell are:

1) The authentication and authorization servers,
2) The communications media/mechanisms,
3) The client machine,
4) The user security habits, and
5) The application database server.

Risk 1: Physical Assault on the equipment. The equipment of concern under these circumstances are the kerberos servers that are providing client authentication, the application servers providing client authorization, and to a lesser degree the routers. These servers are currently in the machine room. If you could get access to them:

1) You could avoid all authentication and authorization checking and access any client server application of interest.
2) You could modify data that you should not.
3) You could damage the security databases cutting off services.

2

2-7-6

Control in Place or Compensating Control: As already stated the servers are in the machine room that is under limited access. Access to the room requires an access card which produces an audit trail of those who have entered the room. One could lock the machines up further, but operators do need access to them if for some reason they need to be rebooted.

Action Item: None.

Risk 2: Telenet Assault on the server from an idle session. If someone has left the computer session idle an individual could telenet to that machine and use that machine's access to gain access to the servers and control the data acquisition system from the idle machine. This would result with the hacker having full access to whatever the initiated session they teleneted to had.

Control in Place or Compensating Control: To do this the hacker would have to know a IP address and query that address during a time of idleness. The probability of this is low.

Action Item: None

Risk 3: Disaster Recovery and Backups on key security servers. Currently there are no formal action plans or off-site tape backups for the kerberos authentication server.

Control in Place or Compensating Control: The fileservers are backed up so the data would be available as long as the tapes are accessible and not damaged.

Action Item: Define a disaster recovery plan and make arrangements for off-site backup tape storage.

Risk 4: The security servers are on a commonly used net in CIT. This makes them an easy target for sniffing the lines from within the CCC building. With that they could find out the server's supervisor password and login directly to the security servers.

Control in Place or Compensating Control: Monitor logins to the server. Investigate unusual activity.

Action Item: Put the machine room on a separate net from the rest of CIT.

Risk 5 : IP Spoofing.

Control in Place or Compensating Control: None

Action Item: Do IP check.

Risk 6 : Passwords passing in clear text gives access to anyone with a sniffer on the net.

Control in Place or Compensating Control: Kerborize application or use Sidecar.

Action Item: Mandate client/server application guidelines to enforce proper use of security mechanisms.

Risk 7: Client infected with a Trojan Horse.

Control in Place or Compensating Control: None

Action Item: User education and security guidelines/awareness. The need to logout and reboot to insure idle machines were not tampered with. Logging out when application not in use.

Summary of Most Possible Concerns

Individuals getting access to information they should not and using that information inappropriately, such as student grades, social security numbers, sensitive personnel information. This could result in public embarrassment for the institution and privacy litigation or failure to comply with FERPA. Our best protection here is to perform and document a yearly survey of practices on other campuses to make sure we follow an "ordinary standard of care" and are not "deemed negligent" in our handling of sensitive information.

The technical group has added many more risks to the list. The analysis broke the application's exposures down by category: risks due to the application, the use of the network, the use of the web server, etc. In addition, a summary of concerns political, legal, audit, public relations specific to that application's information is being developed. This is a work in progress, which I doubt will ever be complete, but has assisted in the thought process that needs be part of new system endeavors. In addition, it should be noted several of the action items have already been addressed.

Risk Analysis 2: Network and FileServer Security

Identification of risks and exposures to the institution need to be done at all levels. From large applications serving the entire campus community to local office applications. Even in the audit office, you have to ask how secure is data on the audit office fileserver. The server is on a Novell network connected to the Cornell backbone with a dial-in capability. It was discussed that the security risks might justify taking the LAN off the backbone and turning off the dial-in modem. The wealth of information that comes to audit via the network from the university systems and the Internet and the ability to work in NYC on documents in Ithaca make going back to that isolated existence inconceivable. We determined though almost all our work is confidential, only the fraud and irregularity documents would present an unacceptable level of risk if they became available. The solution was a policy that all fraud and irregularity documents would be stored on floppies in locked cabinets.

Determining What Has to Be Secure - Data Security

The evolution of data processing from mainframes to distributed processing has put the greatest strain on the attempts to control security from a centralized location point. Distributed processing gives users control over their data processing and to a certain extent responsibility for protecting and securing their own data.

Information must be protected if:
Its disclosure could cause harm to an individual.
Its disclosure could cause embarrassment or loss to the institution.
Its alteration could result in financial loss or incorrect management decisions.
Its destruction could cause an interruption in critical organization functions.

Historically at Cornell, every piece of data was secured by default, unless otherwise specified. This is impractical from an administration point of view, and undesirable. The university works on information. Now Cornell is reevaluating the securing of data. A data administration function has been created, data stewards or custodians have been define, and the question is being asked is there a good reason for securing the data. The data stewards are entrusted to provide proper protection, maintenance, and usage control of the information and maintaining information utility and availability as well as ensuring authenticity and integrity. They are the institutional person most familiar with the use of the data and the legal and political implications for safeguarding it.

Data security requires: 1) classifying the data, 2) determining the types of security control required, 3) accessing the efficacy of existing safeguards, 4) identifying necessary additions and improvements in security measures, 5) determining the availability of resources, 6) determining the level of security coverage needed, and 8) selecting the appropriate security techniques.

Securing Personal Data

The right of privacy an individual's right to determine what personal information can be communicated, and to whom. Privacy is not a constitutional right. Privacy rights have largely developed in the twentieth century, as a mixture of state common law, federal and state statutes, and constitutional law. As a general rule, the courts do not like to get involved in workplace privacy issues. Traditionally, employers, have been allowed great leeway to protect their business by almost any means not clearly illegal. Various cases, both state and federal, have upheld the right of employers to search desks, lockers, file cabinets, and E-mail without a search warrant. Though there are legitimate reasons for companies to do such searches, people do not give up all privacy expectations simply by coming to work.

Under the standard of due care, organizations have a duty to provide for information security. The standard of due care relates back to what the reasonable and prudent person would do in similar circumstances. If a reasonable and prudent person would have foreseen the threat and placed a known countermeasure in place regardless of what the current industry practices are, that may be the context in which a system's negligence will be judged. If managers fail to take actions to make their information systems reasonably secure and as a result someone suffers damages when those systems are penetrated, the organization may be sued.

Information security is still largely an unknown entity to most people, including lawyers. The exact duty with respect to confidentiality, integrity, and availability is still evolving in the courts. Consequently, attorneys are a valuable addition to any information security team. Cornell's Information Technologies Division has recently added a lawyer to their staff. There are several benefits to involving attorneys. They may/can determine that the review findings should be protected under the attorney-client privilege act. They can assist in the interpretations of copyright laws or licensing agreement. And corrective actions recommended by a review team may require legal direction. As a member of an information security team they can assist in the identification of foreseeable threats and countermeasures for those threats, identify standards of due care and the organizational duties to users (including those required by statue), and identify countermeasures for threats, according to what a reasonable and prudent person in similar circumstances would implement.

Securing Student Data

The Family Educational Rights and Privacy Act of 1974 (FERPA) requires educational institutions in very specific ways to ensure the confidentiality of student information. Briefly, it prohibits the posting or disclosure without the student's consent of the following information: 1) student social security number, 2) student identification number, 3) courses elected, 4) grades earned, 5) grade point averages, 6) class rank, 7) date of birth, 8) place of birth, 9) home telephone listing, 10) academic and disciplinary actions, 11) the most recent student educational records from the previous educational agency or institution, 12) financial arrangements between the student and the institution, and 13) any other education record containing personally identifiable information.

Application and System Integration Controls

Business Applications must be secure to insure only authorized proper transactions occur. The new technologies such as local area networks (LANs), client/servers, and distributed computer environments increase the complexity and level of challenge for controlling the computing environment.

Three level of controls are required: 1) General Business, 2) Application, and 3) Project . General Business Controls include development team qualifications, business reasons for the integration, business resumption, change controls, network controls, and access controls. Application Controls include input edit controls, communication controls, documentation controls, user controls, acceptance testing controls, processing controls, and output controls. Project controls include budgets, schedules, performance measures, and project management.

Policies and Guidelines

Computing is a fluid entity but without a container it just flows uncontrolled, unusable. Policies and Guidelines are the structure that contains it. Policies communicate what is acceptable. Guidelines are examples how a policy might be applied to a specific situation. An outline or checklist of detailed procedures recommended to satisfy a policy. In many cases, policies and guidelines are written after the fact. It is important we anticipate the needs and exposures of the future. In many cases we could look to existing policies for guidance. For example, if I call out-of-town friends from work, I must reimburse the university for the phone call. If I E-mail them instead, I still use the university's resource, but are currently under no obligation to reimburse for the personal use.

The availability and the use of computing and network resources is skyrocketing and our staff, faculty, and students need guidance on what are acceptable ways to use these resources. Recently Cornell had two different sets of enterprising students selling Web services using Cornell facilities. It was not clearly communicated to these students that using Cornell's network resources (a non-profit) for commercial endeavors was not acceptable. Policies and guidelines are being written to fill the gap. There is a network administrators group on campus, a maillist containing everyone identified as a departmental LAN administrators, and a LAN administrators manual. In this Cornell uniformly communicates to those responsible for the installation and maintenance of LAN on the Cornell backbone.

There are numerous areas that institutions should create policy to protect themselves, two come to mind immediately, E-mail and unauthorized microcomputer software. E-mail policy should clearly state 1) whether any messages of a personal nature are permitted on university's E-mail system, 2) whether messages sent on the E-mail system are subject to examination, at any time, by management, 3) what actions will be taken if E-mail is improperly used.

Unauthorized microcomputer software policy should clearly informed employees of the company's position with respect to the practice of copying software. Every year, numerous software copyright infringement suits are filed. In 1991, the Software Publishers Association filed about two lawsuits a week around the country, seeking damages of $100,000 per violation plus attorney fees. (The National Law Journal (Dec 9, 1991)) Software copyright and licensing violations put an entire organization at risk of copyright violation litigation, adverse publicity, ethics degradation, unreliable software, loss of software support, and virus contamination.

Security Awareness

Most security breaches are caused by employees acting in ways that undermine security controls. Usually such action is not deliberate. With the widespread use of microcomputers, many security controls are manageable only by the employees themselves. A security awareness program should cover: 1) What should be protected. 2) What employee actions are required. 3) What employees should do if a problem is found. Each employee should know who is responsible for security investigations and should understand the role of internal auditors, the data security administrator, and anyone else involved in investigating a security problem. The controls are everyone's responsibility and concern, not just the computer professionals.

Employees are more likely to follow instruction regarding security precautions when they understand why security is important and controls are needed. The importance of controls should be reinforced by presenting situations they can relate to; users can quickly understand data vulnerabilities if they realize that there is a personal risk involved. For example, most microcomputer users appreciate the impact that the destruction of their hard disks would have on them.

Security Program Topics

Personal conduct
Password management
Physical access controls, Protecting diskettes, and securing equipment
Environmental controls
Information classification, storage, distribution, and disposal
Securing confidential information
Authorization and Authentication
Errors and Information Integrity-prevention, detection, and correction
Backups and Disaster recovery
Legal issues
Portable computers
Copyrights
Viruses

The top efforts on my list are disaster recovery, software piracy, password management, and quality assurance of custom-developed software (even spreadsheet formulas need to be controlled). Only by educating the faculty, staff, and students about the risks and their personal responsibility for preventing misuse of the institutional information and computing assets can you hope to be successful.

Final Topic: Passwords , Authentication, and Authorization

Passwords are problematic. They are too easily monitored, trapped, copied, and replayed over communication lines and on networks. Too often they are copied or written down. Often passwords are too simple and easily guessed. Frequently inadvertently they are disclosed when initially assigned or handed out. People shared passwords. Passwords can be learned by observing the user keystrokes or easily obtainable by decoy or deception. Hackers will trade passwords like baseball cards. And quite often, passwords are changed too infrequently (and too frequently changed back to the original). And yet passwords remain the foundation for much of our security.

With the increasing use of networks and of outside access to computer resources, the need for security has never been greater. Authentication is the keystone in a sound security program. Authentication is the act of verifying the identity of a station, originator, or individual to determine the right to access specific categories of information. Also a measure designed to protect against fraudulent transmission is by verifying the validity of a transmission, message, station, or originator. Based on knowledge of who the user is, we can control access, authorize the user privileges to perform functions and manipulate data, allow the use of encryption engines, and effectively hold the user accountable for his actions. Dynamic password technology, whether implemented in hardware or software is a secure, reliable way to obtain authentication.

Summary

Security is, above all, about people and a continuing commitment to secure and control the computing environment from people at all levels and in all parts of the organization. It is not cost-effective to implement more security procedures than a given environment requires. Risk analysis can help define realistic security requirements and therefore control the cost of security. A risk assessment methodology will define assets, review threats, identify security requirements, and select protective counter measures not only for the computer professional in the organization, but more importantly for the operational and executive management.

It is important to organize your institution for security by instituting security policies and standards and guidelines. Make sure your policies and procedures protect what you want/are required to protect. You will need baseline security controls, a basic set of controls that meet a minimum set of standards that should be in place in all properly run data centers, LANs, and workstations. It is useless for an organization to develop policies, however sound, if the technology is unable to support those policies. Laws against back robbery and theft would be meaningless if banks left money in the open with no guards, vaults, or alarms to protect it. A commitment to data security unsupported by necessary technological and administrative methods is worthless.

Most importantly your institution must have a commitment to meaningful data security. This can start with a security awareness program which covers what should be protected, what employee actions are required, and what employees should do if a problem is discovered. In all cases, the assignment of specific individual responsibility for information privacy and security and for everyone in the organization to accept personal responsibility and accountability is essential for success.

Lock the Door and Throw Away the Key?

. . . *If we cannot provide access to data, why collect it?*

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Abstract

Megabytes, gigabytes, terabytes, and petabytes. Institutions of higher education continue to collect ever increasing amounts of data. The intriguing challenge is not so much collecting the information as in providing useful end-user access. As campus users acquire more powerful computers with easy-to-use interfaces, they have come to expect comparable ease of use and sophistication in their administrative applications, especially when it comes to gaining access to this data.

Providing such access to data raises numerous, interrelated issues: What is the impact on data integrity, security, and data administration? Such issues need to be considered, and institutions of higher education need to institute policies in order to encourage and sustain, effective use. In the end, if the information we collect is not accessible, then why collect it?

Introduction

In many cultures, storytellers have been responsible for accumulating and recalling local histories and information vital to the welfare of their audience. As the guardians of the community's information resources, storytellers have the important responsibility of passing information to the next generation. In a real sense, they are their culture's central database, retrieving and updating data as needed. This information transfer allows succeeding generations to manage their lives and their culture more effectively.

Organizations, including higher education, are becoming increasingly aware that their own "stories"; or, in this case, the data contained in various computer applications, are a strategic asset. Our organizations need the information for day-to-day operations as well as for long-term decision-making. A number of universities and colleges have been pioneers in this area, including Virginia Tech, University of Pennsylvania, Stanford, and University of Michigan. We are increasingly aware that the availability of information is essential in all aspects of the work environment.

Increasing volume of data

This data comes in new forms and delivery mechanisms including sound, picture and virtual reality presentations and from sources as close as the palmtop we are holding or as far away as a repository on the other side of the Internet. The electronic collection of information is relatively new in relationship to the age of many institutions. In the case of Princeton, we have a computerized "history" that represents less than one-tenth of our 250 year life as a university. During this relatively brief period we have accumulated more information than imaginable just 30 years ago. Since we must assume that this collection of information will only escalate, it is important to plan for the future.

In her CAUSE94 presentation, Building the 21st Century Mind, Jennifer James noted that individuals in our current information age have to assimilate 400 times more information than their Renaissance counterparts. To deal with this information overload, users have had to become data literate. Sources and uses of data must be known and understood by all who hope to cope in this age of information.

Greater technology awareness

Awareness of technology is fast becoming part of the societal norm, presenting technology managers with a clientele who is increasingly more demanding. Slow, cumbersome or unnecessarily restrictive systems are viewed with disdain. Technical decisions are open to increased scrutiny based on new levels of awareness and understanding. As a result of this increased technological awareness, new business and academic perspectives are being considered in the delivery of data. A key component of the increasing use of business process reengineering (BPR) is technology. In fact, for BPR to succeed, technology must be creatively utilized.[1]

Impact of Distributed Information Sources

Before the advent of personal computers, the vast majority of an organization's electronic information was centrally managed, maintained, and secured. The historical mindset did not usually include distributed processing. As we all know, the advent of personal computers has permanently changed the way computer resources are distributed. When people discovered the power of computing that they could personally control there was an increasing desire to develop individual or departmental applications, often without consideration of the organization-wide impact. Traditional computing data centers were ill-equipped to manage, much less control, the proliferation of systems.

With this explosive growth in distributed computing, there was a concomitant increase in the number of isolated pockets of data. Shadow systems with financial, personnel, and student information proliferated. Duplicate information in these fragmented data stores was collected, stored, and analyzed. In many cases inconsistent information was separately supplied to decision-makers and the resulting lack of planning and coordination of distributed computing has become a hindrance rather than a facilitator of information exchange.[2]

The pendulum that represents the shift from totally centralized computing to fully distributed appears to be drifting back. That does not mean we are returning to a centrally controlled data center, but does represent a return to some centralized management of data -- but with improved access.

Needs and Benefits of Strategic Planning for Data Access

Changes in the technology environment are encouraging increased demands for data Accuracy, Access, and Accountability. Coincidentally, an even larger and inescapably complex array of pressures facing academic institutions is leading many to focus energy and resources on these "three A's" as a possible avenue to success. The result is that one of the university's most valuable assets, information, is moved up on the strategic planning agenda. What, then, does senior management want?

Data Accuracy

In a nutshell, what institutions want is confidence that the information asset is derived and managed to ensure its integrity and utility. Electronic information is increasingly utilized to make strategic decisions such as budget, enrollment forecasts, and faculty workload. Data that is accurate, complete and concocted according to the needs of the institution is a prized delicacy. It is one best served in ample portions enriched by easy-to-use interfaces, on top of a rich complement of powerful data storage and manipulation tools and covered with a transparent glaze of safeguards to its continued quality. The appetite for complete, timely, and meaningful information from institutional data repositories seems insatiable.

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[1] "Public Sector Reengineering," Government Technology, September 1995, pp. 30-31.

[2] Wayne Rhodes, "Learning to Share," Beyond Computing, July 1995, pp. 48-49.

Access to Information

Information has always had a very high strategic and tactical value. In order to remain competitive, and be cost-effective, organizations must develop a new paradigm regarding access to data. Institutions must realize that data is an important asset that needs to be managed along with other valuable resources.

Our new data access paradigm must reinforce that providing access is not only viewed as a very positive characteristic, but as an essential service. Access to information traditionally controlled by individual departments within organizations is often difficult. In some instances the concerns are that the information will be incorrectly interpreted, or security violated. Convincing those that currently have this stewardship that this sharing of information is important can be a challenging task.

Shared Accountability

Closely tied to the lines of authority is security. Maximizing legal and practical protection against computer theft, eavesdropping, data tampering, and system invasion while providing for statutory requirements, business demands, and easy access by authorized users demands finesse. Information security requires on-going attention and yet has the potential of deterring efforts toward efficient and open data access. Data access models must find a fulcrum on which to balance reasonable risk and functionality if they are to succeed.

This search for an appropriate alignment of the data access model presents interesting issues especially as computing has become more distributed. The redistribution of the data begs a redistribution of authority and responsibility. As people have become technically literate and demand, rightfully, access to information, they also need to accept the responsibility for proper access control. Particularly in client/server architectures, these lines of responsibility and authority are often difficult to construct and maintain.

External Pressures

As if these internal calls for data integrity and management, improved access to information, good information security, and intelligently designed data access schemes are not enough, external pressures of great magnitude must be considered. External pressures from state/federal agencies, legislatures and individual citizens and patrons more than ever before require academic institutions to collect and process accurate information. Accountability for funds, ability to report and forecast university activity, and maintain the overall viability of the institution is all empowered by intelligent use of data.

Sample Approaches

Princeton University

At Princeton we currently have a large number of sophisticated automated systems that support the business and academic functions. These systems vary from new client/server applications to programs that are approaching 25 years of age. As with many organizations, the computer application demands of our users often out-stripped the resources of the centralized software development staff and the legacy systems. As these users became more technically capable they developed satellite systems to fill some of their needs, often with their own set of information. These systems helped to answer some of the computing needs of the university but at the same time increased the fragmentation of information. This growth of distributed data stores, coupled with the lack of full data integration in the central applications, has made it difficult to obtain information.

To remedy this situation, Princeton has embarked on a plan to develop a strong "*infocentric*" architecture. This architecture will serve to break down the barriers that have prevented decision-makers, from students to executives, from having current information. This is being accomplished by the establishment of a data administration function and new directions in application development. There is a strong awareness on our campus that the sharing of information is an important factor in the future management of our institution. This concept is the basis for the mission of data administration, facilitating the utilization of information across organizational units.

One of the first projects to increase access to information is the creation of the Princeton Data Mall. This is the establishment of a multifunctional data warehouse, whose first customers will be the managers of academic departments. When conceptualizing this data resource we visualized a shopping mall, with a varied collection of data "stores", each with its own specialty, some overlap in product availability, ease of window shopping, extended hours of operation, but with a common location, and architecture.

James Madison University

James Madison University faced similar circumstances: aging central systems powered by non-relational, proprietary databases; an increasing number of distributed, and disjointed, spin-off systems; and no strategy to achieve long-term viability. JMU chose to act boldly to achieve greater information sharing. The current project not only replaces the Finance, Human Resources and Student Information systems, but also aims to provide an integrated source of information to which other systems can be joined. The Integrated Information System (IIS) project is in progress and will facilitate the sharing of information and provide new functionality across departments and systems.

At the foundation of this effort is a move to relational database (Oracle) storage and retrieval. To this is added a client/server processing model and easy-to-use data query and reporting tools supported by the application vendor (PeopleSoft). Most importantly, a conscientious effort is being made to craft new policies and practices which offer supportive access to information on behalf of the university.

Success Factors

Senior Management Support

Frequently it is stated that the support of the senior management of an organization is a very important aspect of any successful project. With regard to data access, this support is imperative to help break down barriers such as financial, ownership, and shared access hurdles.

User Involvement

While without doubt the support of the executives is crucial, it is the acceptance of the project by the staff that makes implementation a success. This is particularly true since the creation of new computer systems can place a heavy toil on the individuals involved.

The role of users in the management of information technology projects is increasing. A recent survey by Deloitte & Touche of Chief Information Officers indicates that a vast majority (96%) believes that users should either lead or work as a team with information professionals in managing projects.[3] In addition, integration of user input in the design, development, and implementation is essential. This integration increases the probability that these systems will meet the business needs of the institutions. This has been particularly important in the efforts that have been undertaken at both Princeton and James Madison University.

Data Administration

The basic concepts of effective data administration are not new. Before the advent of personal computers the data was centrally located and management was relatively simple. The advent of distributed computing and client/server architecture has complicated the situation, but the overriding goal of assuring accurate corporate information remains. While many large higher education institutions have established this functionality within their organizations, it is an important issue for all colleges and universities to address.

The establishment of data administration should be a very positive experience, one that can facilitate the utilization of information across the campus. This is a shared responsibility between the technologists and users of information requiring a coordinated effort to ensure access to accurate and timely data.

New Technologies and Methods

With the ever-increasing amounts of data that will be collected in the future, it is important that we continue to scan the horizon for new tools. Moreover, we must seek to provide additional functionality using our institutional data while seeking to involve new data providers and users.

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[3] "Leading Trends in Information Services," Deloitte & Touche, 1995.

In addition, we must find new ways to provide better service and greater value to our institution through well-planned information access and use.

Summary

Today, and probably for the foreseeable future, higher education is under increasing pressure to maximize the effectiveness of many resources, including data. Our ability to collect information has grown faster than our ability to distribute and understand it. To avoid making business decisions based upon incomplete, or even erroneous data, it is imperative that methods be developed to properly manage and distribute this resource.

The growing trend in distributed computing will require new paradigms in the delivery of electronic information. Data located in distributed information systems need to be evaluated for organization-wide impact. These islands of data have the potential to affect the effectiveness of managing information. As we manage these data stores information technology professionals must work closely with the potential users of information. Only through a mutual partnership will organizations be able to fully utilize the electronic stores of information.

Changing technology calls for constant reeducation. However, when access is considered, the education is not limited to learning new technical operations but also an understanding of needs across the university campus and a willingness to rethink one's role in university functions. "We've always done it that way", is out.

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The Realities of Client/Server Development and Implementation

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ABSTRACT

Carnegie Mellon University has made the initial transition to client/server technology. Most previous systems were developed using relational database, fourth generation language tools, C and Unix platforms with a character based user interface. The client/server model involves the use of the client desktop, a Netware server and a database server.

The paradigm shift to client/server should not be taken lightly. There are a number of issues that had to be addressed. These included which client/server tool(s) to use, which project should be the first client/server project, project planning and estimating, development standards and training for both development staff and end users. We also had to worry about end user desktop computing and network issues.

This paper will address these issues and reflect on the lessons learned throughout this process.

Introduction

Carnegie Mellon University is a private research university located in Pittsburgh, Pennsylvania. Carnegie Mellon enrolls approximately 7,000 students and has an annual budget of more than 300 million dollars.

The administrative computing environment at Carnegie Mellon is a mixed bag of hardware, operating systems and applications. These systems are supported by the Administrative Computing and Information Services(ACIS) department. ACIS consists of twenty-six professional and support staff. There are three primary hardware platforms supporting the administrative systems. These platforms are shown in the table below.

Hardware	Operating System	Primary Applications
Vax Cluster (6610,6430)	VAX VMS	Payroll, Alumni, General Ledger
Sequent S2000/490	Dynix PTX	Student Systems
Data General Aviion 9500	DG/UX	Financial Systems

The applications are a combination of commercial and Carnegie Mellon developed systems. The table below summarizes the key applications.

Application	Vendor/In-house
Student Systems	In-house
Financial Aid	In-house
Human Resources	In-house
Payroll	Cyborg Systems
Alumni/Development	Business Systems Resources
Financial Systems	In-house

The development tools used by Administrative Computing and Information Services have been primarily the Ingres fourth generation language (Application By Forms) and C with the Ingres relational database management system.

The primary desktop computer for users of administrative applications is the Apple Macintosh. The desktop environment is 80% Macintosh, 15% Windows PCs and 5% Unix workstations or terminals. The percentage of Windows machines has been growing in recent years.

The campus network is an ethernet backbone. The two primary network protocols being used are AppleTalk and Ethernet.

There are several Novell Netware servers being used for administrative applications. Most of these have been implemented in the last couple of years.

Client/Server Tool Choices

Administrative Computing and Information Services formed a team to evaluate alternative development environments. This team developed a set of criteria for a third party development tool. Several of these criteria were determined to be "drop dead" criteria. In other words, if a vendor did not support these criteria, their product would not be considered.

The drop dead criteria included supporting the Macintosh platform for both development and deployment, supporting the hardware and operating systems already in use, accessing a variety of relational databases, the ability to access more than one database simultaneously and the ability to provide a character based interface without creating a separate set of code.

Indiana University had already gone through a very similar and very thorough evaluation of client/server development tools and shared the results of their work with Carnegie Mellon. This additional information provided some valuable insight into the strengths and weaknesses of a number of client/server development tools.

One of the primary goals in this process was to become independent of any particular database vendor. We wanted to be able to change database management systems without having to re-write applications. Another key goal was to be able to bring information stored in a variety of databases together on one screen. The tool selected needed to be able to access a variety of databases simultaneously. The final goal was to be able to offer a graphical user interface (GUI) front end.

Support for the Macintosh as a development and run-time platform became one of the most difficult criteria along with the ability to support a character based user interface with the same code. There were very few products available that met these criteria.

Uniface, now owned by Compuware, was identified by the team as the leading candidate for a client/server development tool. Uniface met these objectives by varying degrees of proficiency, but better than the competition overall. A Uniface evaluation (proof of concept) was performed by Administrative Computing and Information Services with support from Uniface. An evaluation plan was developed and Carnegie Mellon sent two developers to a week long Uniface training seminar.

The evaluation consisted of developing a simple Uniface application in the Carnegie Mellon University environment. Once the application was developed, it was ported to a variety of different platforms or databases to test these functions.

Uniface was chosen as the preferred client/server development tool upon the completion of the evaluation.

Project Choice

At the same time that Uniface was acquired, a relatively large module of the Human Resources Information System (HRIS) was under development. The majority of the detailed specifications had been completed by the project team. The project team was composed of key campus users, representatives from central administrative offices (payroll, benefits, student employment) and three people from Administrative Computing and Information Services. This project was replacing a paper based process for adding and updating employee and employment information. The project was very visible and had substantial end user involvement. There was concern about developing this important new application in a character based, database specific tool. A discussion was held with the project team regarding the pluses and minuses of switching to Uniface at this point in the project. The primary minus was that it would push back the schedule an estimated four to six months while Administrative Computing staff members became proficient with Uniface and built the infrastructure to support it. The primary plus was that the result would be a client/server application with a native graphical user interface that would be database independent. After weighing the pluses and minuses, the project team agreed to go ahead with the Uniface development. Thus, this application became the first significant Uniface (client/server) application developed at Carnegie Mellon University. This application is known as DRIVE (Distributed, Real-time, Interactive, Validated, Entry).

Major Issues

There were a number of major issues that needed to be addressed once the decision had been made to switch gears and use Uniface as the development environment for the DRIVE project. These issues included project planning and estimating, developer and end user training and infrastructure issues such as desktop computers and network connectivity.

Project Planning and Estimating

Preparing accurate project estimates and keeping a project plan on schedule can be a difficult task when you are very familiar with the tools being used. It is a much more difficult task when working with brand new technology. Because we had no experience with Uniface, it was difficult to estimate how long it would take to develop the application or even small pieces of the application.

There were two major facets to the project planning. The first facet was the planning for the introduction of Uniface. This included training ACIS staff, development of standards and environment configuration. This was the first major application for ACIS using Netware servers as part of the application delivery. Standards for access and security for the Netware servers to both Windows PCs and Macintoshes had to be developed.

In general, we knew that the learning curve for Uniface was rather steep and that it would take some time for the developers to become proficient with the Uniface tools. In addition to formal vendor training, Carnegie Mellon co-organized a local Uniface users group to share in on-site training and provide another layer of support. We also had access to Uniface technical support and user bulletin boards for additional information. The Uniface pre-sales force was well aware of the learning curve and provided assistance in our start-up.

The second facet was the planning for DRIVE which was well underway at this point. The schedule needed to be adjusted for the time necessary to introduce Uniface, plus the time needed to determine what changes needed to be made to the existing design.

General screen designs had been done before the switch to Uniface was made. The graphical interface made these screen designs basically obsolete. The screens were re-designed to take advantage of the graphical interface capabilities.

Uniface provided the ability to do rapid prototyping. We planned to use this ability extensively in the re-design work, as well as to make up time on screens that had not been fully specified before the tool switch.

Training and Development Standards

Obviously, with a new tool and environment there were a variety of training issues. We needed to train developers in the Uniface tools, to train systems support staff in Uniface technical and communications issues and to provide training for the end users on both the application and the Uniface environment.

The first developers assigned to the project were sent to a couple of vendor training sessions. The second group of developers were trained by the first group of developers. Some amount of self-study and trial and error was necessary in making the paradigm shift from the Ingres fourth generation language toolset to the Uniface environment. The training model became "on the job training" for the most part.

One of the issues that confronted the project team was the creation of standards. Since this was a new tool, there were no screen design, coding, deployment or documentation standards in place. Several people worked on various pieces of the standards document. The standards were modified as needed as the project progressed. For example, the Main Menu screen design had to be changed at the last minute due to a technical problem which could not be resolved.

There was a great deal of discussion on how to do end user training. The hope was that the graphical user interface would be relatively intuitive and not require a great deal of training. An inquiry only version of the primary screen was developed and released to interested users. Formal training was not provided but a "quick reference" card and basic documentation were available. The project team hoped this would significantly reduce the training requirement at the time of the production release of the system.

Infrastructure

Infrastructure turned out to be one of the biggest issues of the project. There were a variety of key infrastructure issues including desktop computers, network connections, deployment strategies, security, database access and remote access.

As mentioned earlier, the predominance of Macintosh computers on the desktop was a key factor in the choice of a client/server tool. Many of the Macintosh computers communicated with the campus network using the AppleTalk protocol. AppleTalk is a relatively slow network connection and the client/server model moves a lot of data over the network. A concerted effort was made to encourage end users to convert their AppleTalk connections to Ethernet. Administrative Computing and Information Services worked closely with the Data Communications department to provide timely and low cost conversions. A large number of users did convert their connections, but many still use AppleTalk.

Many of the Macintoshes are older models and do not have adequate resources to run client/server applications. Many of these can have additional memory installed which would help in some cases. The advent of the DRIVE application at the same time as the release of a sophisticated Excel spreadsheet for use in sponsored research budget development brought the issue of desktop upgrades and replacements into the forefront.

Administrative Computing recommends that departments should budget to replace 25% of their desktop computers every year. This, at first, seemed excessive to many users. The current pace of change in desktop hardware and software is so rapid that a machine over four years old is of limited value and it may be difficult to continue to upgrade it at a reasonable cost. When the desktop computer was being used primarily to do terminal emulation this was much less of an issue.

Performance in a client/server environment is much more difficult to monitor and improve. The problem can be the client machine, the network connection to the application server, the connection to the database server, the database system or a combination of all of the above. It is also difficult to simulate a large system load during testing due to the number of variables, especially network traffic, in a complex network environment such as Carnegie Mellon University and even more so in the summer months when student network traffic is at its minimum.

The client/server model that was used involved client software running on the desktop, application software on a Novell Netware server and the relational database management system on a database server. Originally, the database server was on a VAX/VMS machine, but the database was moved to a Data General Unix machine which had a lighter load in order to improve performance.

A key deployment issue was what to put on the local desktop machine and what to put on the Netware server. Application files could be stored in either location. The advantages to storing the application files on the server included not having to worry about whether the user had the most current version running on their machine. On the other side, there was a performance advantage to having the application files on the local machine rather than accessing them over the network. The initial deployment strategy was to put the application files on the server due to the frequency of fixes and enhancements which would be taking place in the early production release of the system. This would make version control easier. A future version of Uniface promises to provide version control when the files are stored on the desktop machine.

Security was another key concern. Security exists at the file server level, database server level, application level and database level. Security at the Novell Netware server level was a minimal issue. No data or source code was stored on this server. In order to reduce the systems management load a single account and password was created on the Netware server for all users of the application. The secure logon occurred at the database server level.

The database can only be accessed by users who are defined as having access to that database. If the user has access to the database, they are given permission to access all data and the application controls which data they have access to. This again was done to minimize the amount of system maintenance work. There are approximately 200 defined users for the application. The user must have an account on the system that is serving as the database server. The user logs into this account at the beginning of running the application. This account connects to a restricted shell that prevents interactive logins.

The application has a fairly-sophisticated access and approval module. The access model is basically hierarchical. Once the top level, executive managers, were defined to the system they defined the users who would have access to their data. Each succeeding level in the hierarchy performed the same process. Thus, the application restricts the employees that any user has access to. The application requires a separate 'save' password before any transactions can be saved or passed on to the next level in the process. This prevents someone from finding an unattended computer running the application and using it to change data.

One of the biggest security concerns turned out to be network security. The client/server model sends a great deal of information over the campus network. That information is not encrypted. Carnegie Mellon continues to explore options for securing the network which will provide the desired level of protection at a reasonable cost.

Ingres is the underlying relational database management system that was used for the DRIVE project. Carnegie Mellon entered into a site license agreement with Ingres in 1986. The site license agreement has ended, but Carnegie Mellon retains a substantial number of Ingres licenses across a variety of hardware and operating system platforms. Thus, there was no additional cost involved for a relational database system for the DRIVE project.

Lessons Learned

There have been a great number of lessons learned throughout this process. Probably the least surprising, but still important is that it will always take longer and it may cost much more than you think.

Client/server Tool

In general, Uniface served and continues to serve us well. This conclusion was initially clouded by serious issues with a Macintosh product which was in its infancy. Uniface provides the graphical user interface, database independence and multiple platform support that were desired. This was born out by the relatively painless move of the database server from a DEC VAX system running VMS to a Data General system running DG/UX two weeks before the release date.

The Macintosh version of Uniface caused several problems. At the time of our tool evaluation, the Macintosh version of Uniface was in beta release and while we saw the demo, we did not have hands on experience. By the time DRIVE was selected as the project, Macintosh support was available. What we found was that the Macintosh platform was simply not as robust as the Windows version. Few Uniface sites using Macintoshes meant that we invested hours in debugging and designing work arounds with very little supportive services to rely on. We have subsequently developed an excellent, post-sales relationship with Compuware/Uniface. (As a note, do not expect the same level of expertise and support post-sales and you will not be disappointed.)

We did not plan adequately for the amount of time that would be spent in working with the vendor and getting answers from technical support. We found that it is well worth the effort to identify all the support services you can before you begin work with any new tool in general. Carnegie Mellon made considerable use of user groups and electronic bulletin boards for acquiring information and finding solutions. More often than not, other users had the answer, and the right answer, before technical support even returned the call. Given all the unique combinations of hardware, network, database and application requirements possible now, a nation-wide search is more likely to provide the depth of experience you need rather than one organization, even if it is the vendor.

Another area that did not get complete attention was the quality of documentation and training. Understanding that the possible number and complexity of client/server configurations is huge, we nevertheless expected to find some documentation depth in areas that pertained to our installation. After substantial trial and error with incomplete and inaccurate documentation we discovered that the only way to get the information we needed was through technical support. In many cases the vendor had additional documentation on specific topics and configurations. We quickly learned to be more proactive about seeking this information before wading through the volumes of outdated manuals. We also quickly dismissed vendor training as a cost-effective way to deal with certain topics. Certain training curricula by nature are more broad than others, standards and guidelines for example. As such, these sessions were worthless to us. Pre-read of training materials and references would have made the difference between time well spent and wasted time. While documentation and training were not high on the priority list, more attention to these topics at the start may have uncovered more efficient methods for building product knowledge.

Another issue that we did not adequately plan for was the possible need for a 3GL routine to perform functions that Uniface could not perform effectively. This was made more difficult by the cross platform nature of the application.

Initial Project Choice

Conventional wisdom and advice from the vendor indicated that the first Uniface project should be a relatively small application with limited scope. The timing for the DRIVE project would not allow for the project to be put on hold for an extended period of time while other smaller Uniface applications were developed. There was an overwhelming desire to not release the DRIVE application using the old, character based technology.

Our project plan called for developing test application scenarios in order to test all of the elements of a client/server application. Developing throw-away applications or test application scenarios in order to test all of the elements was a luxury that we did not have in reality. We achieved the same results by staging the release of a more complex production application.

Carnegie Mellon issued an optional, inquiry-only, pre-release of the DRIVE system. DRIVE Inquiry enabled end-users to become accustomed to the look and feel of the new GUI environment while testing network connectivity, desktop performance, software distribution strategies and printing capabilities. We discovered that many users were connected via low performance networks or had substandard desktop machines. During this pilot period, we were able to concentrate on providing solutions to the configuration problems without having to deal with a live, transaction oriented system. We should have more strongly encouraged the users to work with this application. It was a very low risk application and additional usage would have helped us identify and resolve some of the problems earlier in the project.

Unfortunately, not everyone took advantage of the early release, leaving a huge number of end-users with serious problems when we did go live. Users who made use of the early release also tended to be more proactive about upgrading and developed a more positive attitude about the application and the new computing paradigm. For those who did not, trying to sort out the system configuration, database performance, and network traffic issues from appropriate use of a complicated update system was nearly unmanageable. The experience we had in troubleshooting during the inquiry phase paid off as many of solutions and work arounds were already documented and in production, but the ill-effects of unsatisfied end-users lingers.

Project Planning and Estimating

Project Planning is one thing, plan execution is another. With client/server the complexity increases dramatically and the control decreases sharply. All the rules change. It was difficult enough for us just to identify all of the variables, let alone estimate for them. In the end, there were numerous iterations of the project plan. As mentioned above, we reneged on our original plan to release the application in total and opted instead to stage the release.

Rapid prototyping proved to be both a blessing and a curse. Because it was so easy to change screens, at least on the surface, there were many more iterations of key screens than had been planned for. Scope creep became a difficult management challenge. It was also difficult for the documentation and training committees to work with a product that was constantly changing. Furthermore, we found the learning curve prohibitive for rapid application development in our timeframe. If developers are not fluent in the tool, you will not get rapid application development. If the learning curve is steep, development will not be rapid in the short term.

We found the need to enlarge the scope of the development team. Implementing a successful client/server project required the commitment and teamwork of networking, desktop, mainframe systems, and software development, and of course, end-user groups. It was extremely important to verify that each of these groups understood their place in the critical path of a project as soon as possible. As an organization, we were creating a new breed of project team. We believe that the organization as a whole benefited from the development of cross-functional expertise and by the involvement of end-users in the transitioning to client/server.

Training and Development Standards

After years of developing Ingres 4GL applications, the infrastructure of our development environment was very rich: shared libraries, screen templates, all manner of standards, reusable modules, and a development methodology. Experienced developers devised and conducted training sessions defraying training expenses. Very little of this investment translated to the client/server scenario. Two months of product evaluation and testing produced a rough standards document and a few screen templates. Weeks of off-site training were necessary just to develop an elementary understanding of the development tool. The lack of infrastructure contributed to the additional costs and additional time needed to complete the project. A lack of experience in optimizing for performance cost precious hours in development and troubleshooting.

End User Computing and Networking

Carnegie Mellon has an extremely heterogeneous computing environment. Outside of the student computing clusters, there is no centralized control or published standard for networking or desktop computing. Lack of standards created the potential for each and every client to have a completely unique configuration. When problems occurred, what was once a question or two in the host-based scenario and a simple scan of a central log file, became a litany of inquiries, involving database administrators, network gurus, desktop support personnel and system managers.

In our business division alone, 24 different models of Macintosh computers were in use and 6 different PC processors from a wide range of IBM compatible vendors. Printers run the gamut. Fifteen months after initial campus exposure, we are still working on local printing on a case by case basis.

Factoring in support for multiple user interfaces, Macintosh, Windows and character based, added degrees of difficulty not only for system maintenance and troubleshooting, but also for upfront application design. We found that we began excluding GUI objects from screen design in order to accommodate the limitations of the character interface and thus were beginning to chip away at end-user benefits. In the end, Carnegie Mellon choose to abandon the character mode interface platform because of design barriers, additional training burden, and poor user acceptance.

While client/server boasts the benefit of utilizing the 'power of the desktop' we found that in may cases 'power' was nowhere to be found. Since our existing host-based systems required very little from the connecting 'terminal', many of our end-users had minimal desktop configurations. There are hard and soft costs for the discovery, evaluation, and installation of machine upgrades and replacements when multiplied across hundreds of users. At Carnegie Mellon, the decentralized nature of hardware procurement makes it difficult to calculate the total cost.

Network connectivity must also be evaluated as early as possible. ACIS actually developed a program in concert with the Data Communications department to assist end-users in the conversion of their network connections from apple-talk to ethernet at a reduced rate. Budgetary constraints necessitates early communication to the end-user community about upgrade paths and options. Secondarily, it might be useful to establish a fund for grants to those users who cannot afford the necessary upgrades.

Even though we were proactive in discussing the possible need for desktop hardware and network connection upgrades, this cost still came as a surprise to many departments. The cost of the desktop computing upgrades depended on the equipment in use and the nature of the upgrade required. The costs for the network upgrades were relatively low (< $200), but still caused a great deal of concern among a number of customers. We also used this as a forum to discuss planning and budgeting for normal desktop computing upgrades.

On the plus side, network and desktop upgrades, while imperative for acceptable performance of our client/server application, also increased productivity and performance of the other desktop applications that our end-users were already using.

Other Lessons

We found that we needed to clarify our goals and to refer to them often to stave off both criticism and frustration. Our primary goals were platform independence and a GUI front-end. This was accomplished.

Our developers became very frustrated. Client Server and Event Driven Programming was a paradigm shift for our 3GL and 4GL developers. At the beginning, middle, and even the end of the learning curve, developers felt that they could have programmed faster in their favorite host based, character mode 4GL. In addition, client/server placed an additional burden to have or acquire expertise in other areas like server configuration, network administration, and cross-platform development. Cross-function training was a critical step down the client/server path as responsibilities and requirements changed. Constant reminders of all 'wins' was an important part of winning the development team over to the new paradigm.

It was necessary to teach end-users what client/server entails beyond the ability to use a mouse. Client/server requires certain capabilities of the client machine and the underlying network. Early education and communication was imperative for enabling our users to acquire the minimal and optimal desktop computing configurations.

Conclusion

Administrative Computing and Information Services' first campus-wide client/server application is in production use. Many lessons have been learned along the way. The strong role of the user community was absolutely essential to the success of this project. Our development team has created a strong foundation for future projects. The second release of DRIVE is in development and should be ready for production in January.

Client/Server Architecture for Mainstream Administrative Systems - Bradley University's Experience

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Abstract:

Bradley University is approaching the end of our conversion of all mainframe administrative software to a client/server environment. These mission-critical systems support very large databases and provide multiple users and hardware platforms with a complex array of data entry, verification and reporting options. The following major systems have been/are being implemented in a client/server architecture:

- Advancement -- Summer 1993
- Finance -- Summer 1994
- Admissions -- Winter 1995-1996
- Student Records -- Spring 1996

The presentation will review our approach to client/server administrative applications and focus on our methods of working with system owners to design the client/server applications and to solve the problems and difficulties encountered. Particular attention will be devoted to the following issues:

- Involvement of system owners/users in client/server design and implementation
- System performance in a client/server environment
- Printing and reporting
- Integration with auxiliary applications -- DARS, SPEEDE, telephone registration
- Cross platform integration -- Mac, PC
- Remote access

The University Context

Bradley University is an independent, privately endowed, coeducational institution located in Peoria, Illinois. It was founded in 1897 as Bradley Polytechnic Institute by Lydia Moss Bradley as a memorial to her children and husband, Tobias. Bradley became a four-year college in 1920, and in 1946 became a university and began offering graduate programs. It is fully accredited.

Mainframe Administrative Systems at Bradley

In 1990, Bradley University's administrative systems were centralized on a mainframe computer. These systems were either locally developed, or were purchased software heavily modified by Bradley and no longer supported by the vendor. There were significant problems with these systems: The systems were not implemented in a modern data base management system; the systems were very inflexible; design decisions made in the 1970s were causing numerous operational problems. In addition, the mainframe computer was a proprietary design manufactured by Control Data Corporation. There was a concern that we would face a difficult problem if Control Data did not succeed in the mainframe market.

Scope of Bradley's Administrative Systems:

Advancement		
	Alumni, Friends and Corporations	70,000
	Size of Centennial Campaign	$100,000,000
	Number of users	44
	Remote staff	3
Finance		
	Number of University Accounts (Account+Category)	60,000
	Number of primary users	40
Admissions		
	Student Search Prospects	200,000
	Active Prospects	65,000
	Applicants	3,500
	Freshman target	1,050
	Number of primary users	36
	Number of secondary users	13
	Remote staff	8
Student Records		
	Number of enrolled students	6,000
	Student Records on-line	36,000
	Number of primary users	12
	Concurrent secondary users (potentially all faculty)	30

Preparing for the Transition to a Client/Server Environment

After reviewing the existing environment and projected needs, Bradley University's Information Resources and Technology unit developed a "Computing Initiative" to move the campus from a mainframe environment to a distributed environment. Initially, we did not target client/server as the architecture of choice.

We recommended a phased implementation. The highest priority was the Advancement system. Bradley was to begin a $100 million campaign in 1993. The Advancement staff considered the then-existing system inadequate to support the needs of the campaign. Finance and accounting were given the second priority in part because we felt that the conversion of our system to a "standard" accounting system should be relatively straightforward. Student Records and Admissions were considered the most difficult applications to convert and they were put at the end.

We initially decided to look at purchased systems operating in a mini-computer environment. Technical staff and the major administrative computer users examined a variety of options. None of the systems available at the time provided all the services needed and the prices were too high for the perceived value of vendor-based systems.

A computer industry executive (and Bradley alumnus) recommended that we do a pilot test of the Advancement system in a client/server environment using Rapid Application Development methodology. Because this was uncharted territory for Bradley's administrative development staff, we employed a consultant to serve as the project leader for the effort.

June, 1992, the consultant and one Bradley programmer/analyst began a two month project to prototype an Advancement system based on the needs of our Advancement staff. At the completion of the pilot project, the overwhelming consensus was to complete the project and implement the system. We were able to demonstrate that performance of the system in a client/server environment was better than on the mainframe. Based upon the success of the pilot project, the implementation timetable for the Computing Initiative became:

1. Develop the Advancement system internally. Implement the system in June 1993.
2. Purchase a client/server-based Accounting System. Implement that system in June 1994.
3. Develop internally Student Records and Admissions systems. Implement in 1995.

The Computing Initiative was discussed with senior University Administrators throughout its development. The final budget agreed upon in 1993 was:

Advancement system cost	$45,000
Finance system cost	$95,000
Student Records system cost	$105,000
Admissions system cost	$48,000

Design Issues

We recognized from the beginning that "client" involvement -- the participation of the owners and users of the system -- would be essential to the success of system development efforts. The Rapid Application Development (RAD) methodology was integral to the success of our efforts. In prior development efforts, the time lag between system specification, coding and delivering a demonstrable product was a hindrance to our understanding the needs of the client and delivering the product. Our RAD technique used weekly meetings with our clients to involve them in the development effort. Senior administrators, office managers and front line staff were all involved in the RAD implementation. At each meeting we demonstrated the week's progress, discussing issues and setting milestones for the next meeting. Clients saw the actual functioning of the system as we developed it. We were able to make major and minor adjustments to the system early and continuously in the development cycle.

A further complication was that none of us (including the client) had a clear understanding of what was data needed to support a $100 million campaign. We needed to insure that the system was flexible enough to allow for changing and emerging needs. By demonstrating the ease of program and data base modification, we all felt that we could adapt the system to meet whatever needs developed.

Experience with the Uncertainties of the Client/Server Environment

We knew that a client/server architecture would be fundamentally different from a mainframe or a mini-computer environment. When we began our project, we were not -- and could not be -- aware of the extent of the differences. Furthermore, we could not find successful implementations of client/server "bread and butter" administrative systems either to be purchased or to serve as models.

As we developed this new environment, we encountered a number of technical challenges that are worth discussion.

1. System performance in a client/server environment
2. Printing and reporting
3. Integration with auxiliary applications
4. Workstation configuration and cross platform integration
5. Remote access

System Performance

Client/Server architectures are much more complex than host-based systems. There are many factors that impact performance (generally negatively) including the server, the network and the client computer. Also, monitoring and control of these factors is much more difficult in a client/server environment. Several application development products provide acceptable performance with small data bases, or small groups of users, but cannot provide the performance needed for a modern, large administrative system with a large user base. Our Advancement database consisted of 70,000 individuals and institutions. Normalizing the data resulted in many data tables and millions of records. This environment makes the efficiency of the application development tool and the data base a critical factor. For the Advancement system, we chose a DOS (non-Windows) environment using Clarion as the development tool. At the time, we did not find any Windows based environments that provided adequate performance. The Student Records and Admissions systems are developed in a Windows environment (with some reporting tasks in DOS) again using Clarion.

Printing and Reporting

Printing and reporting offer special challenges and opportunities in a client/server environment. Clients typically have a variety of printers that are incompatible with each other. Also, there exist needs for volume printing in either the user office or the computer center. At Bradley, different offices solved the problem in different manners. The Advancement unit elected to have Computing Services print most reports. The Controller's Office prints to a high volume laser printer in the office. We found that reporting using Windows standards adds significantly to the complexity of the programming task -- dealing with different sized fonts, proportional fonts, page layout vs. line layout. We chose to avoid this on the initial implementation by sticking with a DOS reporting strategy.

Executing report programs is another challenge. Most central host computers are multi-user/multi-tasking systems making background processing of reports a routine task. Desktop computing especially in a DOS environment are single tasking systems, and most users do not want to "give up" the use of their systems to run a report. Also, some reports need to be scheduled for later processing. On a positive note, integration with Word-processing and other office automation software is much easier for users to understand and use than in a centralized environment.

Because we developed the Advancement System internally, we were able to solve this problem to some extent. We have a pair of computers in Computing Services dedicated to running *ad hoc* reports. These computers constantly process reports placed in a report queue. Output from the report servers can be printed on any network printer or saved on a network disk for later processing. During busy times, users have the option of running these reports on their office computers. With the purchased accounting system, we did not have the ability to implement this system. Rather, we installed "extra" high performance computers in offices; clients can use these workstations to run reports without losing productivity. The Student Records and Admissions systems are Windows-based systems; we can multi-process reports and other tasks, though performance suffers.

Early benchmarks showed that the processing time needed for a client performing a massive batch run (for example, grade processing or census reporting) compared favorably to the same runs in the mainframe computer. Attention to the indexes and keys in the data-base has made selection and reporting significantly faster. We provide user-controlled parameters to specify the amount of resources to allocate to foreground processes. While this is just the opposite of what we would like, that's a Windows limitation that we must accommodate.

Auxiliary Applications

The Student Records system has a number of auxiliary subsystems that must be supported in a client/server environment.

- Bradley University has been using voice response registration for a number of years and this feature must be supported in the new system. The voice response system communicates to the mainframe through a single serial line. While we could write a PC program to simultaneously handle multiple conversations, we decided to do this with one UNIX system written in C++ communicating with the application server. This implies that the database management system must be able to support both personal computers and UNIX systems.

- The mainframe student records system audits degree requirements. Reprogramming a degree audit system was such a complex task that we felt it was more than the internal staff was prepared to accomplish in the planning time frame. We purchased the DARS system from Miami University to replace our degree audit system. DARS is an IBM mainframe, CICS-based, system available in COBOL or PL1. We initially thought we would build our own front end to DARS, then just execute the COBOL code to actually produce an audit. We found this another difficult challenge. We maintain degree requirements using a CICS emulator. We devoted our resources to the actual execution of an audit in a user friendly manner rather than devote resource to maintenance of the audit rules database.

- Bradley University was an early adopter of SPEEDE for exchange of electronic transcripts. We use the Supply Tech PC based package. Because we are eliminating a step in the process -- translation between the mainframe and the PC -- the resulting system is simpler than the original.

Configuration and Cross Platform Integration

Bradley University's computing environment is a diverse mixture of IBM-compatible desktop computers, Macintosh computers and UNIX workstations supported by a variety of servers and networks. Our goal is to provide access to our systems from a variety of platforms. We faced two major challenges: the configuration of individual computers is critical to our success; and we wanted to offer the systems on a variety of hardware platforms.

To minimize our development effort we purchased as much software as possible. Application software vendors (particularly in a DOS environment) have a tendency to demand a certain computer configuration. This does not present a problem for individuals who use only a single program, but presents a significant problem to those using a variety of software products. We solved this problem by making extensive use of boot menus.

Windows and other software vendors have a tendency to change the computer's configuration on installation of their software. Often this reduces available base memory to a level that will not support our applications.

Users occasionally change their computer's configuration without contacting us. We have had the entire Advancement system freeze-up because a user configured it to run from a DOS Window -- and allocated no time to the process while minimized.

Many Windows-based applications are memory hogs, reducing available resources below an acceptable level.

We chose not to pursue getting our applications working on Windows95 until after we complete the initial implementation. Our applications do not run under Windows95.

Programmers need to monitor the impact of maintenance on the memory requirements of the destination computers, making testing and debugging a greater challenge.

We have found that DOS emulators will run our administrative software, but users pay a severe performance penalty. Running on Power Macintosh computers with an Intel hardware co-processor provides acceptable performance for a large cost premium. We now require either a 386 or better Intel processor to run our administrative applications.

Remote Access

Dialing in to campus using a modem was supported on one of our first mainframe computers. Running client/server applications remotely is not as easy a prospect. We have two types of remote users. One wishes to call in and access the University's administrative database. We installed several "remote control" computers that are on the Bradley network. Clients call in and take over these computers that are on our local network. This process is conceptually the same to the user as a terminal is to the mainframe.

Admissions Field Representatives run the same program in their remote office (typically on a portable computer) that the home office staff uses. We have a batch program to upload changes to the main database and download new prospects and changed information from the master database to the admissions representative. This has several advantages over a separate and special program for the Field Representatives, including easier training, consistent support, and flexibility so that our staff can move between the field and the home office easily. The software's security features controls the ability of staff to change only authorized data. Security is consistent in the field and at home.

For both types of users, we are experimenting with bridging/routing Ethernet over ISDN telephone lines. We have a project underway to determine if we can provide true client/server applications to our remote clients. For the Admissions field representatives, we are experimenting with a commercial network. We found it difficult to support remote users' modem and communications problems from Peoria.

Benefits

There are two main categories of benefits we have realized from the new systems. The most significant set of benefits result from a good design, using relation database modeling techniques to build systems that are flexible and provide clients with control of their system. While the same system (with a different look and feel) could have been built in a mini-mainframe environment, the benefits associated with the client/server architecture also substantial. These benefits are primarily financial savings and ease of use.

Financial Benefits

The full cost of a minicomputer vs. a client/server system will be about the same IF the minicomputer system consists of a minicomputer and low cost terminals on desktops. If we consider workstations on desktops, there is a clear cost advantage with client/server architectures because the cost of a server is significantly less than that of a mini-computer that would provide equivalent performance.

Even assuming an equivalent cost structure, there are financial benefits with client/server architectures. At Bradley there has been a several year lag between the time the mainframe begins to provide unacceptable performance and the time we upgrade the mainframe, due to the high cost of upgrading the mainframe. Because in a client/server environment the bulk of the computing takes place on the desktop, the incremental cost of improving performance for a particular user is far lower than in a central host-based system. With smaller incremental cost/performance amounts, we can choose a strategy of continuous upgrading rather than waiting for performance to become unacceptable before upgrading the host computer.

We found with our mainframe computer that most computer users were migrating to personal computers to emulate mainframe terminals. Clients preferred to use personal productivity tools on desktop computers rather than on the mainframe. Also, we were installing local area networks to provide shared resources, other network applications and access to the Internet. In this case, we found a significant cost advantage by trading a single very expensive mainframe computer for several low-cost servers. We can purchase high-end servers with all the bells and whistles (RAID, UPS, and built in tape drives) for the mainframe hardware maintenance money and have change left.

Ease of Use

We can provide far more services in a PC environment than in a block mode mainframe terminal. In our DOS applications, we edit and correct each field as it is entered. Pop-up screens with list and scroll boxes are very easy to develop and provide significant help to our clients. We use normal Windows conventions for our Windows products. Once an individual is familiar with Windows applications, the training needed to run our applications is minimal. This is particularly important for casual users such as faculty and advisers.

Frequent users of the systems (particularly data entry clerks) can be slowed down by a poorly written "standard Windows" interface. All of our systems have been written to not require mouse input for data entry screens. On the other hand, the mouse is extremely useful for the point-and-click users (management) of the system.

Because the applications follow Windows rules, we can open multiple administrative applications and multiple instances of the same applications. When a client is in the middle of one task and needs to respond to an inquiry, that individual can open other window, handle the work, then return to the previous task.

Conclusion

The Computing Initiative which began in 1992 has completely transformed the environment for administrative computing at the University. Here is a summary of where we are now on each of those components of the Computing Initiative:

- Advancement -- Implemented on-time -- Summer 1993
- Finance -- Implemented on-time -- Summer 1994
- Admissions -- Implemented December 1995
- Student Records -- Planned phased implementation beginning April 1996

If we were to undertake the project at this point in time, we would do some things the same way, and certainly make some changes, as well. The decision to move to a distributed environment was definitely correct, as was the decision to implement a client/server architecture. Based on our experience, we strongly recommend that client/server applications be given careful consideration at any institution considering advancing from a mainframe environment. We have experienced genuine improvements in both cost effectiveness and user satisfaction through implementing the client/server applications. The Rapid Application Development methodology was also highly successful, although as we gained more experience we made some modifications in the original methodology to take advantage of our increased expertise and the differing desires of clients to be more or less deeply involved in the development process.

We have learned -- through sometimes painful experience -- that it is worth the extra money to buy tested, network-certified servers, with maximum capacity and appropriate, fully-compatible components and peripherals. Our experience with systems assembled from a variety of manufacturers has been that it has taken a great deal of time and expertise to assemble, tune and later enhance the systems, causing downtime and problems for users.

Our original intent to purchase developed software from reputable vendors would still be our first choice now -- and there are now a number of choices available that are worth consideration, which was not the case when we begin implementation. However, we have found that we can provide far better service to our users if we have access to source code, so that we can appropriately debug, problem-solve, and modify applications to meet the specific needs of our institution. We will certainly be considering vendor-developed and -supported software as we add applications to our client/server environment.

Now that the Computing Initiative is nearing completion, it would be nice to think that we could sit back and rest on our laurels for a few months -- or at least polish up the final modifications, finish debugging, etc. In the real world, however, that is not an option. As soon as we have programmers free, we need to begin the cycle of development again, porting the Advancement System to a Windows environment, upgrading servers and networking for the whole architecture, resolving some nagging problems, and adding "essential" enhancements to meet user needs. In addition, we need to fully integrate all of the applications, develop an executive information system, develop a data warehouse structure to support institutional research ... well, you get the picture.

It has been very important that we have had -- and continue to receive -- the support of senior administration and our users, as we push to provide the best possible systems and service to meet the University's needs. Those are the essential realities that underlie the decisions that we have made. Based on our experience, client/server architecture can be an important element in reaching those goals.

Internet Tools Access Administrative Data at the University of Delaware

by Carl Jacobson

The introduction of NCSA's Mosaic browser ignited a fire of interest that is changing the face of the Internet and the way we deal with networked information. The scramble for commercial success on the Internet has brought many technology vendors into the Web trade, resulting in the development of new tools and methods. As these advances define the role of commerce on the Internet, they will also change the way we conduct routine business on our networked campuses.

Internet Tools Access Administrative Data at the University of Delaware

by Carl Jacobson

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The World Wide Web offers a new model for application development in colleges and universities. At the University of Delaware, for example, Web tools are effectively being employed to produce multi-platform administrative applications. Web applications are quickly and easily crafted to interact with administrative databases, providing powerful, new functionality. Web applications cross most client platforms and can be simultaneously GUI- and character-based, reaching users of both old and new desktop hardware. Web tools are particularly suited to customer outreach efforts, delivering direct service to students, faculty, and staff. The capabilities of the Web's HyperText Markup Language (HTML) facilitate new classes of applications, including hyper-reporting, mixed media, electronic forms, and kiosk services.

Administrative systems and customer service

The University of Delaware provides widespread access to its administrative systems, delivering improved customer service to students, faculty, and staff. The Internet's free, public, outreach tools (World Wide Web, Gopher, and e-mail) have been merged with the institution's closed, proprietary administrative systems (student records, human resources, and financial management).

Private, personal information, including student and employee records, is integrated with the public, general information of the campuswide information system. Freely distributed clients for DOS, Windows, Mac, UNIX, and timeshare users allow access to official, production data on both MVS and UNIX platforms. The methods employed to achieve this success are simple, inexpensive, and easily adapted.

While the administrative systems of the University can be characterized as closed, proprietary, controlled, and secure, the student view of computing is open, pedestrian, public, and wide-reaching. In keeping pace with trends toward a more student-centered campus, Delaware's administrative systems have been reworked to place an emphasis on self-service. Self-service technologies have been applied to deliver timely information directly to the customer. These technologies empower the customer and provide cost-effective, automated services that know no geographic boundaries. Self-service technologies include interactive voice response dialogs, kiosk systems, debit-card transactions, and World Wide Web applications.

Technologies merge

With a healthy portfolio of mainframe-based administrative systems, Delaware chose to adapt existing information resources to open, network technologies, in order to meet the goals of improved customer service.

It is impossible to grant the large, expanding customer base direct access to mainframe-based information systems. Faculty and research users of "academic" machines have little desire to log on to "administrative" machines and navigate through unfamiliar territory in search of needed information. Nor is it feasible to allow 22,000 students to log on to the administrative mainframe to review grades on the day they are posted. These closed, proprietary systems must be opened to allow such "pedestrian" use. Administrative information services must be adapted to behave more along the lines of a publicly available campuswide information system (CWIS).

To meet these goals, Delaware chose to leverage existing resources by merging

- *the established, closed, proprietary mainframe-based administrative systems with*
- *the emerging, open, public, client/server- based campuswide information systems*

in order to

- *deliver customer service in the environment of the customer,*
- *do "administrative things" in "the student way,"*
- *allow the free, public access tools of the Internet to be used to do official university business.*

The key to successfully merging these technologies is compromise. It is necessary to bring the security of the administrative environment to Internet tools, while opening the administrative systems to Internet protocols.

As Delaware first turned to the Web for administrative support, official institutional data were maintained using Software AG's ADABAS database system and processed by programs written in COBOL and NATURAL. At the same time, CWIS information was collected, maintained, and delivered on the World Wide Web. The use of Web browsers was widespread among campus customers, while existing Natural/ADABAS systems were robust and useful. These disparate resources were combined in a unique but simple way to deliver improved information service to students, staff, and faculty.

This combination requires the transformation of the "host" of a host-terminal system into the "server" of a client/server system. The host and its associated applications become part of a client/server network enabling outreach and supporting diverse data types.

Opening closed systems

The opening of such closed systems focuses on the need for secure servers to translate Internet protocols into the languages of the administrative systems. Web HTTP (HyperText Transport Protocol) servers meet this need, functioning as effective gateways between the Web browsers and administrative programs and databases.

Such Web gateway servers may be built or bought. Several HTTP servers are available commercially at surprisingly low cost. Apple's Internet Server and Netscape's Commerce Server are examples of general-purpose HTTP servers that provide packaged sets of tools needed to develop Web applications. They are popular, inexpensive, vendor supported, and utilize economical hardware.

While commercial gateway servers provide the convenience of packaged toolsets, they may require additional hardware, new communications protocols, and unfamiliar programming languages. As an alternative, special-purpose HTTP servers can be developed in-house to perform these translations directly on existing hosts. Interpretive servers may be written on any networked platform, using any language supporting Internet communications interfaces.

This approach would, for example, allow COBOL programmers to open legacy systems to the Web using the tools, techniques, and training of the legacy environment. While Web browsers expect information to be packaged using HTTP, they are not concerned with how that packaging is performed.

Whether built or bought, gateway servers use standard HTTP to communicate with Web browsers on the user side. On the application side, these servers employ common gateway interfaces (CGIs) to communicate with external programs and databases. CGIs are programs or scripts, and may be written in many languages, including C, Perl, and AppleScript. CGIs allow Web servers to communicate with other servers, DBMSs, external programs, screen scrapers, and a variety of network program interfaces.

CGIs may be used in conjunction with DBMSs and programming languages to build complete, new administrative applications, or CGIs may play the role of transforming closed, proprietary administrative systems into compelling Web applications.

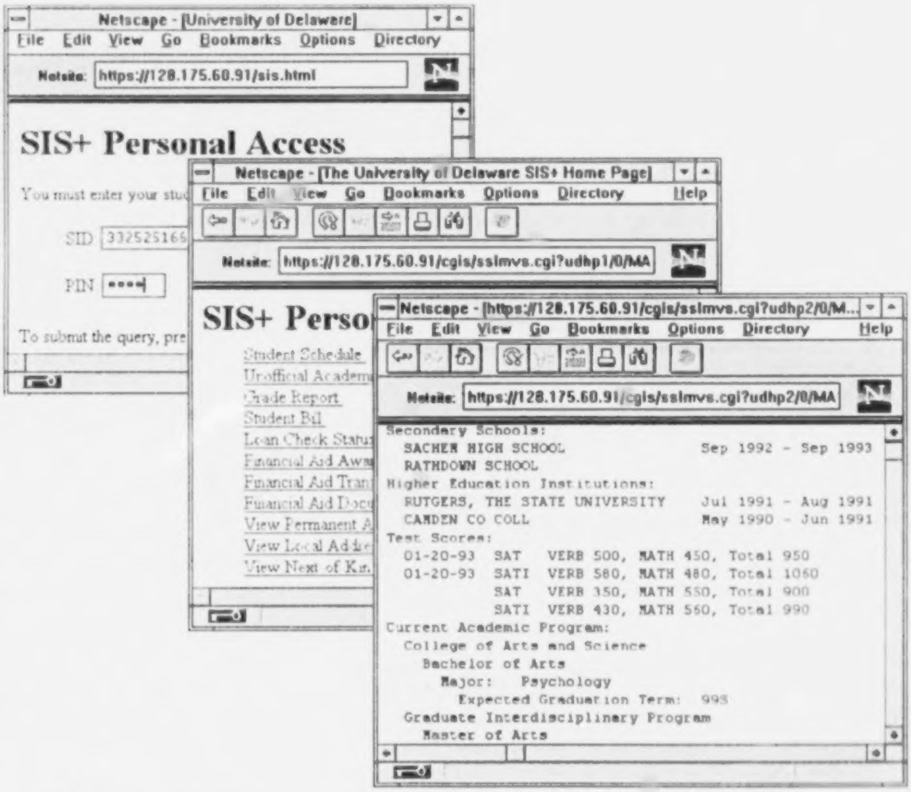
With many Delaware administrative systems residing on an MVS mainframe, interpretive servers were developed to run in this environment, accept Internet packets, recognize Web HTTP protocol, and call administrative application programs based on the content of these packets.

With interpretive servers speaking to administrative programs, existing tasks such as transcript production can be reused rather than re-developed. Upon request from a student client, the server simply invokes the existing COBOL transcript program. However, instead of printing or displaying the results, they are packaged in a Web packet and sent out onto the network.

Authentication, authorization, and encryption

In order to provide the levels of security needed in conducting personal business, authentication, authorization, and encryption routines must be employed.

With an overall design goal of "using existing resources whenever possible," security schemes used for touch-tone registration were enlisted at Delaware to provide similar protection to the Internet clients. Student-ID and PIN (Personal Identification Number) authentication was already known and in use by students and staff. PIN-based authorization tables were already in place in existing administrative systems. (Exhibit I illustrates the Web SID/PIN authentication and access to records.)


Netscape - [University of Delaware]
File Edit View Go Bookmarks Options Directory
Netsite: https://128.175.60.91/sis.html
Netscape - [The University of Delaware SIS+ Home Page]
File Edit View Go Bookmarks Options Directory Help
Netsite: https://128.175.60.91/cgis/sslmvs.cgi?udhp1/0/MA
Netscape - [https://128.175.60.91/cgis/sslmvs.cgi?udhp2/0/M...
File Edit View Go Bookmarks Options Directory Help
Netsite: https://128.175.60.91/cgis/sslmvs.cgi?udhp2/0/MA

SIS+ Personal Access

You must enter your stud

SID 332525166

PIN ****

To submit the query, pre

SIS+ Perso

- Student Schedule
- Unofficial Academ
- Grade Report
- Student Bil
- Loan Check Statu
- Financial Aid Awa
- Financial Aid Tran
- Financial Aid Docu
- View Permanent A
- View Local Addre
- View Next of Kin

```
Secondary Schools:
  SACHEM HIGH SCHOOL                  Sep 1992 - Sep 1993
  RATHDOWN SCHOOL
Higher Education Institutions:
  RUTGERS, THE STATE UNIVERSITY       Jul 1991 - Aug 1991
  CAMDEN CO COLL                      May 1990 - Jun 1991
Test Scores:
  01-20-93  SAT   VERB 500, MATH 450, Total 950
  01-20-93  SATI  VERB 580, MATH 480, Total 1060
            SAT   VERB 350, MATH 550, Total 900
            SATI  VERB 430, MATH 560, Total 990
Current Academic Program:
  College of Arts and Science
    Bachelor of Arts
      Major:   Psychology
        Expected Graduation Term:  998
  Graduate Interdisciplinary Program
    Master of Arts
```

Exhibit I: *Using Secure Web Browsers, students first provide SID and PIN numbers to gain access to a menu of services. A simple point-and-click on "Unofficial Academic Transcript" produces, in real time, a complete student transcript. All data displayed on these screens Is protected when crossing the network using public key encription.*

BEST COPY AVAILABLE

In order to protect the authentication information as well as the private records of students, faculty, and staff, Netscape's Secure Socket Layer (SSL) encryption protocol was adopted. This protocol was selected because of the popularity and success of the Netscape's Web browser and because its socket-level encryption is ideal for supporting the re-use of existing authentication and authorization schemes.

SSL uses encryption to enhance user privacy by providing a communications channel that is secure against eavesdropping. When an SSL-aware browser connects to an SSL-secured server, all information passing between browser and server is fully encrypted. This secure data circuit allows existing authentication and authorization information to be safely exchanged on the network.

SSL is not the only security alternative available to those wanting to do business on the Web. Secure HTTP, Digest Access Authentication, Shen, and DCE-Web security are several examples of current Web security efforts.

Stateless client/server relationships

A significant advantage to adopting the Web-server model to provide student services lies in the "statelessness" of these servers. The transactions may be viewed as "stateless" in that a server has no lasting connection with each requesting client. The server "comes alive" upon receiving a request message, interprets and fulfills the request by passing a message back across the network, and returns to a "wait state" until the next user request comes along.

Since students do not log on to the administrative system, there is no data communications overhead. A single task monitors an Internet port and responds to customer requests. This "stateless" client/server relationship allows many customers to effectively use administrative resources without becoming members of that environment.

Without the overhead of CICS or TSO sessions, a mainframe server performs its simple tasks with little impact on the overall system. Response is immediate, even for longer packages such as student transcripts. In addition, due to the nature of the Web itself, the response time expectations of Web users are lower than those of interactive, transaction-based systems, so that if a delay is encountered, it is unremarkable.

Such interpretive servers have the advantage of accessing production data directly. They need not rely on data extracts, but instead return timely and accurate information from official production records. As students perform touch-tone drop-add, they can immediately confirm schedule changes. As students pay bills, they can quickly print summaries of charges and payments. With many business transactions reaching databases in real time, it has become necessary to report these changes in real time. "Just-in-time" production of course schedules and transcripts calls for this level of timeliness. The stateless Web server allows this to be accomplished easily and inexpensively.

At Delaware, servers have been deployed to run on MVS, UNIX, and MacOS platforms to allow information to be gleaned from various databases across campus and to take advantage of the relative merits of each operating system.

Training and support

With Web browsers already in the hands of students, faculty, and staff, the issues of training, support, and software distribution are minimized. Student grades and transcripts may be accessed in a manner familiar to all existing Web users, allowing students to use these tools to conduct institutional business (see Exhibit I), as well as to explore academic frontiers.

Client-side development costs are usually a large portion of a client/server budget. However, Web applications differ from the popular client/server model in that all Web development effort is on the server side. Since Web client tools are free and widespread, client-side costs have been kept to a minimum.

Server-side development may be as simple as re-routing the formatted-text output of a COBOL report program to a routine to place the output in an HTTP packet. In many cases, there is no need to add HTML codes to a formatted text document and no need for application programmers to learn the details of HTML.

However, HTML syntax is easy to learn and enables application developers to transform simple, pre-formatted text reports into powerful hypertext documents supporting multimedia and user input.

Software distribution

One strength of the client/server model of computing is the increased functionality provided at the desktop. Not only can Internet browsers access grades and course schedules, but they can also retrieve and display images, sounds, and even brief video clips. Any "digital object" of reasonable size can be delivered to any client workstation. This includes the delivery of client software itself.

In keeping with the goal of "self-service," Delaware's Internet client software is stored on a Web server and made available to anyone in the campus community across the network. A simple point-and-click causes the newest version of a program to be loaded across the network to the user's hard drive.

For Web applications themselves, the bulk of processing code remains on the "server side," and version-control is centralized. HTTP mark-ups are, in effect, software code that is delivered and interpreted in real time, ensuring that the most recent code changes are invoked by every user.

The Web's hypertext capabilities provide for easy access to associated documentation for all network-delivered software.

Classes of application

The powerful capabilities of the Web enable the rapid develop of new classes of administrative applications. While formatted text reports such as course schedules and transcripts can easily be delivered to Web browsers, the hyper-linking and multimedia features of the Web offer exciting new potential. The Web's hypermedia model expands the potential of administrative computing.

Hyper-reporting

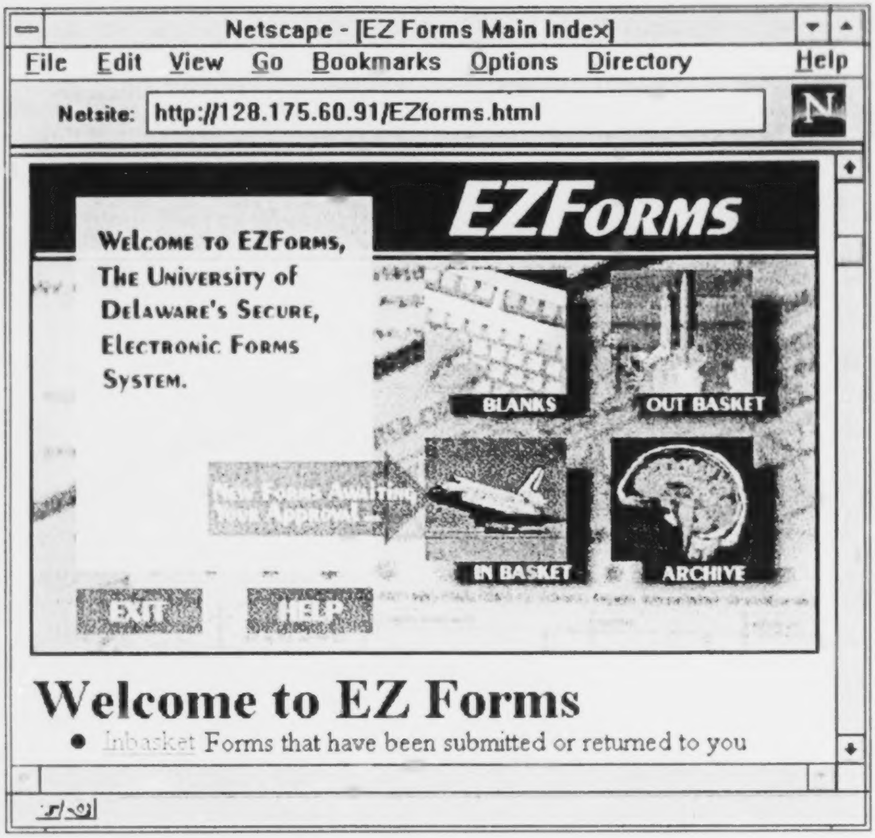
An HTML document may be linked to any other document on the Web, creating a powerful hypertext application that may be used to produce hyper-reports. Hyper-reporting can be used to link existing summary reports and detail screens to produce effective executive information systems. Institutional executives may receive regularly generated summary reports with built-in "drill-down" capability, with links to official, detailed, production data from administrative databases.

Mixed media

Web hyperlinking also supports diverse data types, such as photographic or document images. Student demographic data may be gleaned from a legacy student information system, while student photographs are retrieved from a UNIX-based image server. Both could be merged seamlessly by the desktop Web browser.

Electronic forms

Web browsers support fill-in-the-blank forms with ease-of-use features such as scroll boxes and radio buttons. Paper forms used for routine campus business may be effectively replaced by electronic documents, available to users on all platforms and routed and processed on the campus network. (See Exhibit II, an illustration of the University's forms home page.)


Netscape - [EZ Forms Main Index]
File Edit View Go Bookmarks Options Directory Help
Netsite: http://128.175.60.91/EZforms.html
EZForms
BLANKS
OUT BASKET
New Forms Awaiting Your Approval
IN BASKET
ARCHIVE
EXIT
HELP

Welcome to EZForms, The University of Delaware's Secure, Electronic Forms System.

Welcome to EZ Forms

- Inbasket Forms that have been submitted or returned to you

Exhibit II: *Groupware applications requiring collaboration, routing, and approval are ideal candidates for the Web.*

Touch-screen, multimedia kiosks

PODIUM,[1] a multimedia authoring tool developed at the University of Delaware, has been made "Internet aware," allowing it to "speak" Gopher and Web protocols. This tool, originally designed as a classroom technology, is now used by several institutions to develop compelling multimedia, touch-screen kiosks—merging image, sound, and video with administrative information. PODIUM is an early example of an emerging class of tool, facilitating the construction of special-purpose browsers for custom Web applications.

Evolving Web capabilities

One of the primary strengths of the Web is the ability to deal with diverse data types—the ability to support multimedia objects. Complex data objects may be sent across the network and "unwrapped" and "displayed" at desktop browsers. In the future, these objects will become even more complex. For example, an electronic form and its associated processing rules might be delivered directly to, and processed locally on, the client workstation.

Vendor efforts, such as Sun Microsystems' Hot Java, demonstrate the ability to deliver secure program code as an integral part of a Web transaction. This capability will redefine distributed computing, allowing host servers to deliver machine-independent code to desktop clients for just-in-time processing.

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Conclusion

Rapid advances in the development of tools for the Internet will impact the processes of teaching, learning, and research at our institutions. Many of these same advances will contribute to the way we conduct business and affect daily campus life for students, employees, and visitors.

The World Wide Web is emerging as a new model for administrative service on our campuses. With the application of emerging tools and technologies, existing resources can be re-used effectively to return immediate benefits for small investments. Each early adopter of these technologies will gain valuable experience and insight into the issues of delivering networked services and will establish a foundation for controlled growth and change.

Development Checklist

As the Web capabilities listed below demonstrate, Web development offers many advantages over traditional application development methods.

✔ *Multi-platform*
Web clients exist for DOS, Windows, Mac, UNIX, and other popular operating systems.

✔ *Low cost*
Commercial Web browsers are available to educational institutions at no cost.

✔ *GUI*
Web applications may be simultaneously GUI- and character-based, delivering functionality to users of older desktop hardware.

✔ *Mixed media*
Web protocols support images, sounds, and video clips as well as text, allowing character-based administrative data to be merged with these rich data types.

✔ *Common user interface*
Although Web browsers run on disparate platforms, a certain look and feel is maintained across platforms, providing an easy-to-support common user interface.

✔ *Software distribution*
Web browsers themselves may be easily and inexpensively distributed across the network, using the Web itself.

✔ *Self-documenting*
Hypertext capabilities allow application help and tutorial routines to become an integral part of any Web application.

✔ *Distributed servers*
Web browsers merge information from several servers onto a single screen, without specific user knowledge of these servers.

✔ *Network security*
Socket-level encryption provides a secure network communications channel that can be employed to protect any existing or emerging campus authentication scheme in addition to all user data.

✔ *Local processing*
As Web browsers employ "helper applications" to display and process information, Web applications can therefore make use of local processes, such as spreadsheet or word processing programs.

Additional Resources

Visit Delaware's administrative Web site (http://www.mis.udel.edu/admin.html) for live demonstrations of secure business transactions. A Web version of this paper with hyperlinks to demonstrations and other relevant resources can be found at the URL http://cause-www.colorado.edu/cause-effect/cem95/cem9533.html

"The Web: A New Model for Application Development," a CAUSE95 pre-conference seminar to be held November 28 in New Orleans, will provide an opportunity to explore, in depth, the use of the Web for application development. Seminar leader Carl Jacobson will target a general audience, addressing technical issues of interest to programmers and DBAs in the non-technical language of managers and directors. For more information about CAUSE95 activities, visit the CAUSE Web server (http://cause-www.colorado.edu/) or Gopher server (gopher://cause-gopher.colorado.edu/) or call 303-939-0315.

FOOTNOTE:

[1] PODIUM is an object-oriented multimedia application generator developed by Professor Fred Hofstetter. For more information, see http://www.udel.edu/lynam/fth/podium.html.

A Successful Path to Client/Server Applications Through Rapid Application Development Methodology With a Self-Directed Work Team

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Abstract

In providing optimal service to customers, Information Technology departments are faced with many challenges. One of the biggest is making the transition to a distributed applications environment with minimum impact on current structure and plans. With support from key areas, North Carolina State University has taken an innovative approach to moving into the Client/Server arena using Rapid Application Development methodology and a dedicated work team. We were able to build and maintain momentum installing Client/Server applications, while continuing to maintain legacy systems and respond to existing customer requests. This paper will demonstrate a proven, successful path to the understanding and implementation of developing technology.

Introduction

One of the greatest challenges facing IT professionals today is how to implement Client/Server applications and maintain momentum in the Client/Server arena without negatively impacting the application development staff's ability to stay on top of an overwhelming backlog of work. Failure to take advantage of new technology is an unacceptable alternative.

With the support of the University Administration and a few key customers, Administrative Computing Services at North Carolina State University was able to take an innovative approach to solving the problem. By creating a new application development team, operating as a self-directed work team, and employing major components of Rapid Application Development (RAD) methodology, we have quickly and successfully moved into the Client/Server arena. We also have been able to maintain momentum in this environment and to explore and implement new technology as it becomes available.

Our work team completed one cycle which resulted in the production installation of legacy data extract databases available to Campus for ad-hoc use and three client/server applications serving a varying number of customers. In addition, we charged a Continuous Quality Improvement (CQI) team to explore the implementation of Object Oriented technology and methods. We have now begun the second cycle with the new development team. The new charge shifts focus from medium/ long-term projects to short-term projects with a high impact on improving processing efficiency within Campus departments. This shift in focus was, in part, brought about by budget cuts and staff shortages. Long range plans will include the development of Executive Information Systems using Object Oriented technology and methods. We are committed to continued advancement.

Developing the Plan

North Carolina State University had a backlog of requests from the customer community and a small IS staff to respond to those requests. Our customers were becoming used to working in a Windows environment and expected their new applications to use GUI standards and "leading-edge" tools. Our customers demanded easier, less restrictive access to their data. Faced with the restraints of the existing backlog, the maintenance of legacy systems, and previously committed resources, we sought innovation solutions. To address these changes, we needed to assess the feasibility of changing the way we have traditionally operated without losing sight of the need to stay responsive in the existing environment.

Based on customer demands for high-quality applications, more user-friendly interfaces, and quicker turnaround, as well as a desire to follow new industry trends, we determined that Client/Server applications were the answer to our needs. A pilot team composed of application developers and systems support personnel was formed to evaluate hardware and software needed to operate in the Client/Server environment. Over the period of a year, the pilot team, working with a small group of friendly, progressive customers, developed several small applications using a variety of tools. At the end of this evaluation period, the decision was made to use Sybase as a database engine and PowerBuilder as the primary development tool. We began researching alternatives to allow us to maintain the status quo while we moved forward into the Client/Server arena. The plan was to:

- Identify the developers to do the work
- Choose an efficient development methodology
- Expand the existing toolset
- Identify projects that were candidates for this environment
- Sell the plan to the customers

Implementing The Plan

We soon recognized that we could not respond as quickly as necessary working within the framework of the existing application development teams. A result of the work done by the pilot team was the implementation of three Client/Server applications in three different customer areas. These applications were used to sell University Administrators and Campus customers on the benefits of moving into the Client/Server arena. Management became convinced Client/Server development was the direction we needed to go and committed to support the effort. Five new positions were created and assigned to the existing application development units. The new positions allowed us to establish a new applications development team. The team, called the Distributed Applications Resource Team (DART), developed applications and provided other customer resources using emerging technology. Each of the existing development units assigned one staff member to the DART team. The team members were rotated annually, providing a means for all staff members to participate and be trained in the new environment. The first group included one senior project leader, two senior programmer analysts, and two junior programmer analysts.

As we read about and discussed the experiences of other institutions and organizations and evaluated development methodologies, we concluded Rapid Application Development Methodology (RAD) had evolved into the methodology of choice for Client/Server development. RAD offered the flexibility needed to develop applications of varied size and complexity and was conducive to mixing with more traditional methods. RAD also promoted increased customer involvement in the process and demonstrated to the customer, first hand, the commitments they would need to make to move successfully into the new environment.

Our internal management decided that the DART team would operate as a self-directed work team. The team was staffed with developers with varied skill levels and experience who were participating as volunteers. By functioning without a supervisor, all DART team members would share equally in the success or failure of the project. It was necessary for team members to evaluate new concepts and work toward meeting team, rather than individual goals. Main criteria for choosing projects for the team were:

- The task could be completed in a relatively short time
- Would have high visibility when implemented
- Would alleviate some of the stress on the existing development units.

Executing The Plan

All members of the development units within the organization had received training in Sybase, SQL, and PowerBuilder. All members of the initial DART team had participated on one of the pilot teams and had some experience in relational databases and Client/Server development. To allow the DART team to become comfortable working in a new environment, the team's first assignment was to continue developing the legacy system extract databases that were begun by the pilot team. This allowed the DART team to get to know each other and to acclimate themselves to the self-directed team concept. This process also assisted us in meeting the goals of the organization by providing easy access to legacy data for the customers which, in turn, alleviated some of the workload from the existing development units. Once extract databases were established for financial, purchasing, student, and vendor data and the Campus was provided with a user-friendly inquiry tool, the customers were no longer dependent on IS support to access their data. This reduced the number of requests to the existing development teams. The extract databases were also highly visible in most all areas of the campus community.

A division-wide application to track staff training was selected as the first Client/Server software package to be developed by the DART team using RAD methodology. The team began the process working with requirements from the primary customer. From the initial requirements document, we laid out the first draft of the database design and developed a high-level prototype for the main functions of the application. From this point through production implementation of the application, the package was developed using RAD methodology. Joint Application Development (JAD) sessions were held to allow the developers to work through the prototype and to interact with customer representatives. JAD sessions allowed developers to assess the customer's reaction to application elements and to change the prototype, as needed. Important knowledge about their preferences for the look and feel of the model was gained. The customers were able to see what the application was going to look like and how it would work before a single line of code was written.

After the first two JAD sessions, components of the package were assigned within the DART team and coding began. As programming of the major functions of each module was completed, the module was made available to the customer for testing. The customers and developers worked in a mode of iterative project development, one module at a time, and each module was installed into production following completion of testing by the customer. The application had been broken into logical pieces and each piece was delivered upon completion. This process let us incrementally install the Application Modules and let the customer work with sections of the package as they came available. A key benefit of the process was that the customer could initially populate the database through the application which provided part of the training necessary for their staff. The end results of following this process were:

- The customer began using the application much earlier in the development process than was normal with traditional methodologies
- The customer was actively involved in the development throughout the entire process
- The deliverables required much less change than normal
- The application was what the customer needed and wanted
- Delivery was made within a shorter time frame than we felt would have been the case using a traditional approach

This initial experience with RAD methodology reinforced our decision that RAD was appropriate for developing Client/Server applications. The process took longer than we had expected, but we felt the quality of the resulting product was significantly better than using traditional methods and that time was saved by not having to revisit code and enhance the product to what the customer really wanted.

Iterative prototyping was very helpful in giving the team a true feel for what the customer liked and for identifying needs and expectations. We felt that the process provided the customer with a "feel" for the new technology, and it exposed them to new terminology. The process enabled us to make changes easily, encouraged brainstorming, and uncovered elements of the application that might have been missed. The customer was much more involved in the design process, reactions to the application were easier to gauge, and pitfalls of the design were exposed very early in the process.

The JAD sessions were invaluable. They required a commitment from the customer to make available the resources necessary for the project to be successful. Consequently the DART team did not have to wait for customer availability to move forward with the project. To use JAD successfully, the right people must be involved. Decision makers, as well as people who understand and use the process the application is accommodating were required. We found the sessions to be much more successful when attainable goals were set before each one. Our experience showed it to be important for the developers to know the requirements and have a prototype before the first session. It was important that roles be assigned to each developer for each session so that everything that occurred was documented and nothing was missed. We learned to listen to everything that was said by each person involved.

Iterative project development and incremental installation of the application provided many plusses to the process. One of the biggest benefits was that this technique allowed for early discovery of problems. The DART team had the luxury of being able to deal with problems at a more leisurely pace than if many problems surfaced at once during system testing of an entire application. We were able to make logical adjustments to the design instead of applying stop-gap measures. This development method kept the customer actively involved throughout the process and provided working modules of the application as the project progressed. This involvement boosted staff morale within the customer environment and assisted in gaining customer confidence early in the process. It helped to eliminate surprises at final installation, provided a built-in method to expose the customer to the client/server environment, and resulted in a higher quality application.

The increased involvement of the customer in the development process when using RAD methodology was also valuable from the developer's standpoint. Even reluctant customers were led into a hands-on involvement in the project from start to finish. Iterative development techniques provide them with a venue for discovering design problems, omissions, and mistakes very early in the cycle. They have more of a feeling of being in the driver's seat and have a sense of accomplishment and ownership of the application, take pride in the final product and feel a need to share "their" application with their contemporaries.

The Learning Experience

Following this process was a real learning experience for the developers and the customers. It gave us a good insight for developing with RAD, operating with a self-directed work team, and keeping pace within the framework of developing technology.

RAD does not allow for skimping in the design process. Detailed attention to the database design process is essential. The database will be the foundation from which a good application can be developed. It is critical to have a prototype available for the first JAD session. The prototype is the tool that gets the customer's attention and motivates their involvement. The development team should set reasonable goals for each JAD session so that the team and the customers leave the sessions with a feeling of success and accomplishment. Roles should be assigned to each development team member for each session so that nothing is missed. Examples are:

- One person to facilitate the session
- One to track requirement and database changes
- One to operate and change the prototype
- One to keep minutes

The DART team used laptops during sessions to perform their assignments. Roles should be rotated at each session. It is important that the right application and customer for the first project. The customer needs to understand the commitment they have to make for the process to be successful. You must take care not to create unrealistic expectations of the time frame of the project.

One of the most important factors in ensuring the success of a self-directed work team is to choose the right people to serve on the team. Members must be open to new ideas, be willing to cooperate in the self-directed environment, and be willing to commit to the concept. One of the members should be appointed to the role of integrator. This role can be rotated to alleviate the feeling that the integrator is a supervisor. The integrator's role is to:

- Ensure adherance to standards
- Coordinate the pulling together of application modules
- Oversee system testing
- Serve as the customer contact
- Direct the flow of information within the project

Client/Server technology is evolving continually. It is important to use CASE tools when they are available to facilitate and help to document the development of the application. The project team should continue to explore new tools for design, development, creating on-line help, testing, and documentation. You cannot be afraid to experiment and you should never tell a customer that a request cannot be fulfilled without first exploring for a way to accomplish what they need.

Continuing The Process

The process we at North Carolina State University have followed to move into the Client/Server arena has been very successful for us. One of the key benefits has been that management has had the flexibility to change direction when necessary. We can adapt to shifts in focus brought about by emerging technology or customer desires without negatively impacting progress. The second generation of the DART team started out focusing on learning about data warehousing and moving towards developing a data warehouse for the University. In response to the impact of legislative budget cuts and mandates to downsize throughout the campus and to the desire of the University Financial Officers to improve processing efficiency within departments, the focus of the team shifted to taking on short term projects to achieve more efficiency. An emphasis has been placed on publicizing campus wide applications as well as departmental applications that may be sharable. Campus departments are helping by funding both contract and student staff on a temporary basis to supplement the development team's productivity. At this point, the DART team is a dynamic, flexible group with no long term commitments. In addition, there is a group operating as a Continuing Quality Improvement (CQI) team to explore and evaluate new software, hardware, and ideas. The CQI team operates under the direction of the Administrative Computing Services Research and Development unit. Members consist of staff from all areas of Business and Administrative Systems Division. They are currently evaluating Object Libraries, Object Oriented development tools, and will be recommending a future direction for applications development at North Carolina State University.

We feel that we are on the right track for providing our customers with "Leading Edge" solutions to their problems. We have been able to assist other institutions in moving into the Client/Server arena and consider ourselves to be progressive in this area. The process we have followed to move in a new direction in applications development is one that has been highly successful for us and one that we are proud to share with our peers in hopes that we can help others to be equally as successful.

Data Warehousing Puts New Life into Legacy System

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The major focus of this presentation is to explain how Ferris State University (FSU) is developing a data warehouse application to deliver timely, accurate student information to college-specific customers. This presentation will benefit anyone who wishes to serve academic customers by providing an PC database environment for working with legacy data.

Two underlying factors led to the development of this application. A more timely method for delivering reports to college staff is needed at a time when Information Services (IS) staff resources are diminished. The mainframe-based Student Information System presents information on an individual student basis; whereas, colleges often need to view student information in an aggregate form by college, department, course, or advisor. This application is designed to empower the customer to design and create reports and queries based on their individual needs with the ultimate outcome being an improved service to students.

PROJECT OVERVIEW

In recent years, Ferris State University (FSU) has experienced the re-engineering of many procedures that were once a common practice in daily office routines. In the fall of 1993, the University converted all academic programs to a semester calendar which necessitated the implementation of the current Student Information System (SIS). This change in technology brought about a new way of doing "business" across campus. A large majority of the batch reports previously produced by the Information Services department were no longer valid or usable. Hundreds of new on-line screens were introduced causing office staff to revise their methods for accessing student information.

At the time the University was learning to use this new system, it was also experiencing a decline in student enrollment. This led to financial constraints and reduced staffing in many areas, including both the Information Services department and the college administrative offices. At a time when the University needs to improve student services to remain competitive, it is facing a critical challenge in meeting that need. College administrative staff need to be able to easily access and summarize student information in order to serve students in a timely manner.

In an effort to re-engineer the process by which college administrators and faculty acquire information, Ferris State University is developing a data warehouse approach to working with legacy SIS data. Data delivery tools placed on client workstations allow staff to extract data from the warehouse for local data analysis and reporting.

RATIONALE FOR IMPLEMENTATION

Two underlying factors led to the development of this application. A more timely method for delivering reports to college staff is needed at a time when Information Services (IS) staff resources are diminished. The mainframe-based Student Information System presents information on an individual student basis; whereas, colleges often need to view student information in an aggregate form by college, department, course, or advisor. The data warehouse application is designed to empower the customers to design and create reports and queries based on their individual needs with the ultimate outcome being an improved service to students.

The traditional approach to accessing student information takes either of two routes: 1) a request for information is sent to the IS department, describing the data needed and the format in which it is to be printed, or 2) the data is viewed on-line through the use of CICS screens. There are limitations to both approaches that hinder timely access to information.

Limitations in the Delivery of Information

Several factors lead to a less-than-satisfactory turn around time for delivering information to the department or person requesting it. One factor is the limited number of programmers in the IS department. There are currently six full-time programmers available to respond to incoming report requests from over 16 functional departments, seven college administrative offices and various faculty and management personnel. In addition, fulfilling reporting needs constitutes only a portion of their workload. These report requests must be prioritized along with other application development, maintenance, and support tasks. This workload delays the delivery of information for days or sometimes weeks. If users need to query the IS department for assistance every time they require access to critical data, vital decision-making time is consumed and opportunities can be lost.

A second factor that often leads to frustration for the user/customer is the process of printing and delivering the needed report. The majority of reports currently generated are printed centrally through the Computer Operations department and delivered by the campus mail service. This type of delivery adds at least another day to the process. Recent implementation of an on-line Report Distribution System has alleviated some of this frustration. However, most users continue to request the information in hard copy form.

One last item that needs to be discussed is the effect budget limitations has had on this traditional approach. With the recent restructuring of academic programs and the drop in previous levels of enrollment, the university has had a difficult time in maintaining staffing levels -- not only in the IS department, but across campus. As other departments become lean and need to "do more with less", they are turning to the already downsized IS staff for technological solutions to enhance the effectiveness of their workflow. This puts an additional strain on IS resources to meet user needs for timely information.

Limitations of Mainframe Transaction-Processing System

In 1993, the university purchased and implemented a mainframe-based Student Information System (SIS). This system offered the ability to process semester-based data and added greater functionality than our previous student record system which had been in use for over 15 years. While this new system meets the needs for processing admission, financial aid, academic program and student account information, it lacks the capabilities of providing information that is readily available or useful for management decision-making activities.

This SIS system is a basic transaction-processing system utilizing CICS screens for data entry and verification. The application code is written in traditional COBOL language which is used to process data stored in VSAM file structures. This structure prohibits easy access for the average user and requires programmer intervention to turn this data into useful information. In addition, all on-line screens are based on individual student name or identification number. This system works fine when specific student data is needed but does not provide executive information capabilities for summarizing the data into easy-to-digest formats, eye-catching graphics, or analytical trend data.

THE DATA WAREHOUSE APPROACH

The initiative for the data warehouse approach resulted from several circumstances coming together at the right time. As an IS manager, responsible for application systems and development, I was well aware of the current limitations of our present Student Information System and the ineffective process for delivering timely information. At the same time, I was enrolled in FSU's graduate program for Information Systems Management and was contemplating ideas for a thesis project. The two situations converged during a meeting with the Assistant Deans. Representatives from the Information Services department, including myself, were presenting a PC-database approach for accessing university financial data. This meeting evolved into a discussion of student information reporting needs with the Assistant Deans expressing their desire for a similar PC-based system for accessing student data. Considering the current backlog of requests in the IS department, it was decided that the best approach would be to develop this student data warehouse as my graduate program thesis project. Development activity could occur after normal work hours and would not interfere with other priorities in the IS department.

Implementation Highlights

The main objective of the thesis project is to define and develop a student information data warehouse on a SQL server that will be easily accessible through the use of client/server technology and PC-based reporting tools (e.g. MS-ACCESS). These features will provide selected end-users in the college offices with the capability to create their own reports, perform search and sort functions, produce mail-merge documents, and view data on-line in an Windows environment -- all from their individual client workstations. Thus, end-users will be empowered with effective management tools for planning and decision making.

In the initial planning phase, several discussions with the Assistant Deans from each college demonstrated the need to have multiple types of information relating to student data (e.g. recruiting and admission data, degree requirement information, and alumni relationships). However, after considering the resources available and the timeframe in which a useable application was needed, it was determined that a subset of this information would be used as a pilot project. Therefore, the initial data warehouse will be populated with data pertaining to currently enrolled students only. An eight-step implementation plan was developed for creating the data warehouse application (see Table 1).

Table 1

Step	Activity	Target Date
1	Determine immediate data needs for development of warehouse database.	April, 1995
2	Evaluate and select data warehouse platform.	June, 1995
3	Select PC-based reporting tools.	July, 1995
4	Determine workstation hardware requirements.	October, 1995
5	Extract mainframe student data for import to data warehouse.	October, 1995
6	Develop reporting applications for initial use and training activities.	December, 1995
7	Train pilot group and solicit feed back.	February, 1996
8	Develop database administration procedures and system reference manual.	March, 1996

Step 1 involved a review of the IS department's most commonly received requests for information. The outcomes of this review were discussed with the Assistant Deans and were refined to include only biographic and enrollment information for currently registered students. The initial data that will be stored in the data warehouse includes the following:

- student biographic information such as name, birth date, handicap, citizenship, gender, and ethnic origin
- local mailing address of student
- permanent mailing address of student
- enrolled program of study, including college, degree, department and major
- current enrolled courses, credit hours, etc.
- current GPA, attempted hours, etc.

Step 2 covers the evaluation and selection of an appropriate platform to use for storing the files associated with the data warehouse. A Windows NT server running Microsoft's SQL Server software was selected for this purpose. This decision was based on a combination of factors. Previously, a Windows-NT server had been purchased and was controlled by the IS department for research and development purposes. Its only use at the time of the data warehouse implementation, was for a similar development project. Therefore, it could easily be allocated for the new project without conflicting with other university needs. In addition, the SQL Server software would provide a centralized relational database that could be queried to transmit only the requested data to the user workstation.

Step 3, the evaluation and selection of PC-based reporting tools, was based on three factors. These include its ease-of-use, integration to other Windows-based software, and its technical sophistication and potential for growth. The MS-ACCESS database product was selected as meeting these requirements and went on to become our university standard for PC databases.

Step 4 involved the selection of workstation hardware that would support the MS-ACCESS requirements for memory, disk capacity, and processor type. A specification sheet comparing these requirements with current workstation configurations was distributed to each of the seven colleges. This comparison chart was used to determine the upgrades needed for each workstation that would be equipped to access the data warehouse information.

Step 5 was the easiest step for me to accomplish. Being the manager of Application Systems, I was frequently involved in extracting data from our mainframe system. This same type of extract process is used daily to fulfill the many report requests received in IS. The only learning that needed to occur was how to the import the data into the SQL Server warehouse to be queried with MS-ACCESS.

On the other hand, Step 6 is probably the most training-intensive and time consuming piece of the development. Not having worked with either SQL Server or MS-ACCESS before, I was starting at ground zero. Intense self-training exercises are conducted in "off" hours to prepare myself for development of the front-end, user-interface portion of the application.

Step 7 will involve training selected end-users from each college on the use of the delivered applications and the types of further reporting capabilities that can be accomplished. The goal is to develop four report/query applications and one mailing label application to deliver with the final product and to use for training purposes. This step is currently in the planning phase. The pilot group of users has been selected and includes one or two key users from each of the college administrative offices. Training sessions will be conducted by the application developer and will concentrate on two specific areas: 1) a demonstration on how to generate the delivered reports through the user interface, and 2) other report, query, and analysis functions available in MS-ACCESS.

Step 8 includes the development of database administration procedures along with a system reference manual. This process, although included as the last step of the project, will be ongoing throughout the development phase. Items contained in the reference manual will include the following:

- Schedule of data warehouse "refresh" procedures
- Procedures for adding new fields to the data tables
- Copy of extract programs used to transfer data from the mainframe SIS system
- Extract file definitions
- Copy of table layouts and definitions for each table in the data warehouse
- A data flow diagram of the system

The completion of the data warehouse along with the deliverables specified in each step is scheduled for March, 1996.

Impact on Customer Functions

The implementation of this data warehouse approach to student information will have a significant impact on customer functions related to data gathering and analysis. More timely information is provided for review by administration since information is available as soon as the data is queried. An improvement in data quality results from direct feeds of data to the warehouse, eliminating errors produced by manual data entry and the consequences of making decisions based on erroneous information. Hours of staff time that were involved in manual data collection can be freed up to add valuable interpretation and background information to reports. Data presentation can be tailored to the needs of different audiences.

The implementation of this proposed data warehouse application will enable the college administrative offices at Ferris State University to make effective management decisions regarding their enrolled student population. They will be able to readily access the information needed to verify and analyze college, program, department and course enrollment statistics.

The use of PC-based software on the client workstation adds the potential to access, manage, analyze, and present the warehouse data in various formats. Class lists, course registration audits, and departmental reports can easily be produced. Search and sort capabilities will result in faster data lookup and make specific student information more readily accessible. The ability to summarize, report, or project specific college or program data will be available. The integration with other Windows-based tools offers the potential to graphically analyze and view trends in enrollment data.

Local printing capabilities will be available to produce mail-merge documents, hard copy reports, or student mailing labels. This will relieve some of the need for the Information Services department to produce, print, and distribute ad hoc reports. The ability to quickly access and view student data and/or reports in an on-line Windows environment could result in a significant savings in paper costs.

Changes in Information Services Role

The implementation of this data warehouse approach to student information will significantly change the role in the Information Services department when fulfilling report requests and other information needs across campus. By empowering the college administrative staff and faculty with the ability to generate their own reports, mail-merge applications, and student mailing labels, the backlog of report requests received by IS can be significantly reduced. Technical staff time can be freed up to work on more complex programming issues. Other technological advances can be developed to meet university needs, resulting in a more challenging and rewarding work experience for the technical staff.

Reduced operational support will be needed for printing and mailing reports, resulting in less overtime pay to an already overloaded operations staff. Paper costs for the IS department can be greatly reduced while resulting in more attractive reports being produced locally in the colleges.

FUTURE PLANS

The primary objective of a data warehouse is to give end-users faster, easier, direct access to institutional data so that they can make quicker, more-informed and better decisions. This initial data warehouse project only targets a small percentage of the reporting and data analysis needs across campus. Used as a pilot research project concentrating on currently enrolled student data only, it is hoped that the outcomes will provide significant insight into the methodology, impact, and usefulness of this approach for meeting data access needs in other areas. These same techniques can be used to access data in the financial, human resource, or alumni/development systems.

Setting the Stage for Client/Server Architecture

As technological advances progressively move to client interfaces for ease-of-use and direct access to decision-making data, so, also, must the underlying architecture support these client needs. In general, the mainframe provides a great deal of reliable processing power and storage space for large database systems. However, it does not provide adequate interfaces for easy access by the average end-user. On the other hand, microcomputers have relatively friendly and powerful user interfaces, but they lack the storage and processing power of larger computers.

In a true client-server system, computers share the processing load. The data warehouse approach allows each computer to do what it is best at. The administrative functions of the university are based on mainframe systems that are tuned for high-volume transaction processing (e.g. registering students, crediting and debiting university accounts, and issuing paychecks and W2 forms). By placing the data warehouse on a separate SQL server platform, the efficient processing of the University's operational systems will not be compromised by ad hoc queries against the data they contain. In turn, the data warehouse can be tuned to provide optimal performance for ad hoc queries from the client workstations.

Improved Customer Relations

The growth of this data warehouse to include additional stores of data from multiple sources will lead to improved customer relations throughout the university. Staff will be motivated to re-tool, data accuracy will be improved, and many workflow and decision-making processes will be re-engineered for improved effectiveness. Several other factors relating to this potential include the following:

- **Decision Support**. FSU is currently engaged in developing an Executive Information System (EIS). Decision-support capabilities will provide all interested parties with the information necessary to make the best possible decisions regarding the status and progress of FSU. Included in the benchmarks relating to the development of this EIS are the considerations for existing databases, accurate and reliable data, and alignment with the university's Information Technology Strategy. The development of this data warehouse will add to and strengthen our portfolio of EIS tools.

- **Decentralization of Ad Hoc Reporting**. With ad hoc reporting responsibilities currently placed in the IS department, customers are not always fully aware of where their requests fall in the prioritization process or what currently exists in the programming backlog. The development of the data warehouse will provide end-user departments with the ability to produce their own ad hoc reports. The "ownership" of the programming backlog will shift from the IS department to the colleges and customer departments. Prioritization of reporting needs will be done within individual departments and will not conflict with other campus needs.

- **LAN Server Consolidation**. The promotion of a central server for data warehouse processing lends itself to a streamlined process for data entry and administration. Many departments currently maintain data on local servers and individual workstations. This often results in the duplicate entry of data originating from the same source. By consolidating LAN servers into a central database server, this redundancy of effort can be eliminated. The central server can handle the database processing while the client receives only the data that was requested. This model causes minimum network traffic.

- **Continuous Quality Improvement**. This data warehouse approach will provide for more accurate, reliable data. Duplicate departmental databases that may not be systematically maintained to assure accuracy will be no longer be needed. In addition, this approach will empower the customer to detect exceptions from the norm by providing new perspectives on production data. These exceptions can be noted and reported to the owner, building a continuous effort to provide quality at the source.

CONCLUSION

Ferris State University is committed to improving customer service. By providing easier methods for accessing institutional data, customers can have needed information at their fingertips for improved decision-making, analysis, and reporting. The implementation of this data warehouse approach for student enrollment information, will move the university one step closer to that goal. To date, the project is well underway, and is currently being evaluated for use in other areas.

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University of Pennsylvania

CAUSE 95

Assessing Risk: Developing a Client/Server Security Architecture

November 22, 1995

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Introduction

The University of Pennsylvania's new Data Warehouse and Financial Systems are exploiting technology to bring to Penn flexible new ways to organize and manage data, making it readily-available for both operational and planning needs. Along with the benefits of the new technology, however come risks which the University must address to ensure the integrity of its information assets. The decentralization of data and computing and the use of open networks, open systems and open standards exposes Penn to new vulnerabilities. Penn can no longer rely on the use of obscure operating systems and networking protocols to protect our systems and our information.

The Client/Server Security Standards Task Force was created to identify the threats to information security posed by the new technologies being adopted for the Data Warehouse and Financial systems. This report documents the threats which the group feels are most serious, and provides a rationale for the group's recommendations.

Bringing Together the Right Players

As Penn planned the implementation of Oracle-based Financial Systems and the Data Warehouse, it was apparent that careful thought would need to be given to how to assure the security of information in the new technical environment. For that purpose, the Client/Server Security Standards Team was formed, with the following mission:

> *Ensure that as Penn moves from mainframe-based computing to distributed, client/server computing, it can ensure the security of administrative systems and data.*

Care was taken to ensure that other planning efforts were taken into consideration, and were involved as necessary in the task force's work (e.g., campus-wide Distributed Computing and Network Architecture task forces).

Scope

Figure 1 shows that the initial focus of the team is on the implementation of Financial systems and the Data Warehouse; subsequently, attention will be given to the broader implications for administrative computing University-wide. The first phase of the Data Warehouse application was implemented in December, 1994, and additional phases will be implemented over time. Additional modules of the new Financial System are expected to be available in July of 1996.

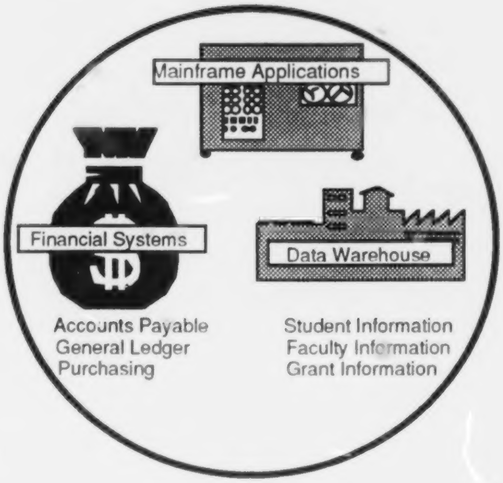

Figure 1 - Scope

While the group's charge did not initially include mainframe computer applications, the group came to believe that the following mainframe security issues should be included in the project scope:

- *Sniffing* To the extent that ethernet is used to connect to the University mainframe (about 40% of all mainframe connections), the legacy applications are no more immune to password or data sniffing than the new Financial Systems and Data Warehouse applications running on the server. Any data which travels over ethernet is subject to sniffing. The team felt that while the primary focus of the group is solving the problem of sniffing for the Financial Systems and the Data Warehouse, consideration should be given to how such solutions may apply to mainframe applications.

- *Single Sign-on* The new Financial and Data Warehouse applications will create new accounts and passwords for users to remember. The team felt that any recommendations for strong user authentication must include an assessment of the costs of mainframe integration, permitting a single sign-on for administrative system users.

Technical Environment

The technical environment for Project Cornerstone consists of a large, multi-processor Unix server connected via the campus' baseband enterprise network to a variety of desktop computers. Users will either connect via Telnet , or by making a client/server connection to an Oracle server using Oracle's proprietary SQL*Net client/server product via the TCP/IP protocol. Data will be exchanged between the Unix server and the mainframe. Financial system implementation plans and timing are presently under review.

Methodology

The team took the following approach to fulfilling its mission:

1. Survey other institutions for information
2. Identify trends in information security technology and practices
3. Identify the information assets we are trying to protect.
4. Identify the threats to those assets. Who might the actors be? How might threats be carried out? What are the implications of the threats.
5. Rank all of the threats. Consider only those threats which are credible and which could inflict significant harm to the University.
6. Validate the threat analysis with a knowledgeable focus group
7. Develop solutions to the credible/harmful threats.

Information from Other Institutions

Based on an informal survey conducted by Penn State in the Winter of 1993/1994 and reported verbally to members of College and University Information Security Professionals (no written report available) of eight private and five state educational institutions:

- 77% of the respondents have not updated their policies to address the migration to client/server architectures.

- 38% of the respondents require that all backbone-attached devices must have User ID/ password or other authentication mechanism.

- 54% of the respondents are planning to migrate to more secure authentication mechanisms than passwords - rated from most to least important: Kerberos, tokens, encryption, signatures, DSS.

- 54% of the respondents required badging or card systems to gain physical access to telecommunications installations.

- 24% of the respondents are now using tokens or smart cards.

- 54% of the respondents are employing a firewall on at least some systems/networks. The effectiveness of firewalls was ranked as somewhere between "effective", and "somewhat effective" (the choices also include "ineffective").

- 77% of the respondents are not encrypting data in local LAN environments.

- 24% of the respondents are encrypting data between buildings and facilities.
- None of the respondents are encrypting data over WAN communication links.

Based on informal discussions with peer institutions, the following themes emerged:

- Some institutions which continue to run their administrative computing over SNA or similar proprietary protocols have not had to face the security challenges of open systems computing and may choose to wait for the solutions to catch up to the problems before wading in.
- Of those institutions facing the problem of open systems, client/server computing, many applications are still in their infancy, as are the solutions to the corresponding security problems. We spoke to a large number of organizations that were conducting limited studies or pilots, or limited implementations of security solutions. Concerns expressed about the solutions included scalability, performance, and the long-term viability of the solutions given confusion over what standard(s) will emerge.

Trends in Information Security Technology and Practices

The following trends were identified:

- Movement away from re-usable, plain text passwords to one-time and/or encrypted passwords using the following technologies:
    - DCE/Kerberos
    - Authenticator tokens
    - S/key - one time password algorithm
    - Public key digital signatures backed up with proof of authenticity "certificates"
    - Digital signature (and encryption technology) embedded in hardened PCMCIA-compatible smart cards: e.g. Fortezza card.
- Movement away from embedding security features (authentication, encryption, non-repudiation) in high-level applications (e.g. PGP, Kerberos) to lower, more pervasive levels in the Internet protocol, making security more transparent to users:
    - Secure Sockets Layer (SSL) from Netscape
    - Private Communication Technology (PCT) from Microsoft
    - SKIP (Simple Key Management for Internet Protocols)
    - Internet Protocol version 6
- Increasing use of firewalls
    - External firewalls

  - Internal firewalls
  - "Private" internets with firewall address translation

- Network-based tools for auditing host security

  - SATAN
  - ISS
  - Pingware

- We found no single, unified and comprehensive solution to the security problems posed by client/server computing in the heterogeneous technical environment we face. Organizations working on these problems are probably best served by accepting that problems may have to be solved on a piece-meal basis with solutions that may be obsolete in less than two years.

Assets and Threats to Those Assets

Figure 2 shows some of the assets that the Client/Server Security Standards team was charged to protect, and the threats against the assets. Information and infrastructure assets are at risk from threats which may originate either from within Penn, from the outside Internet, or which may simply be the result of an accident. The group was charged with developing recommendations for solutions to protect against the most credible and harmful threats.

The project team developed a complete list of the threats to the information assets. These threats were divided into three categories: **threats against the desktop** (7 identified); **threats against the server** (15 identified); and **threats against the network** (8 identified). A rationale was then articulated to explain the team's reasons behind its assessment. Finally, the threats were ranked along two dimensions: the **likelihood** that the threat might take place, and the **harm** that would be experienced if it *did* take place. Both these rankings were done on a "high/medium/low" scale.

The most credible and harmful threats include the following (rationale follows in italics):

1. **Desktop Computer Data Disclosed:** *Someone discloses sensitive information (e.g. payroll information, student grades), which was obtained without authorization from a desktop computer. As more data is available to be downloaded , and as it becomes easier to download, this risk will increase.*

2. **Desktop Computer Data Altered or Destroyed:** *Either intentionally (someone gains unauthorized access to a desktop computer) or unintentionally (hard disk crash, flood, fire, accidental file deletion by the user) , data is altered or destroyed. Since altered data is difficult to detect, it presents a special threat.*

3. **Passwords Compromised by "Trojan Horse" Program on Desktop:** *A "Trojan Horse" is a program that performs unknown, and unexpected as well as expected tasks. It is either placed on a system without the owner's knowledge, or it is placed there by the owner, ignorant of any harmful effects. One example is a program which logs the user onto a system (expected) while at the same time storing the password in a hidden file (unknown, unexpected) for later collection and illicit/inappropriate use.*

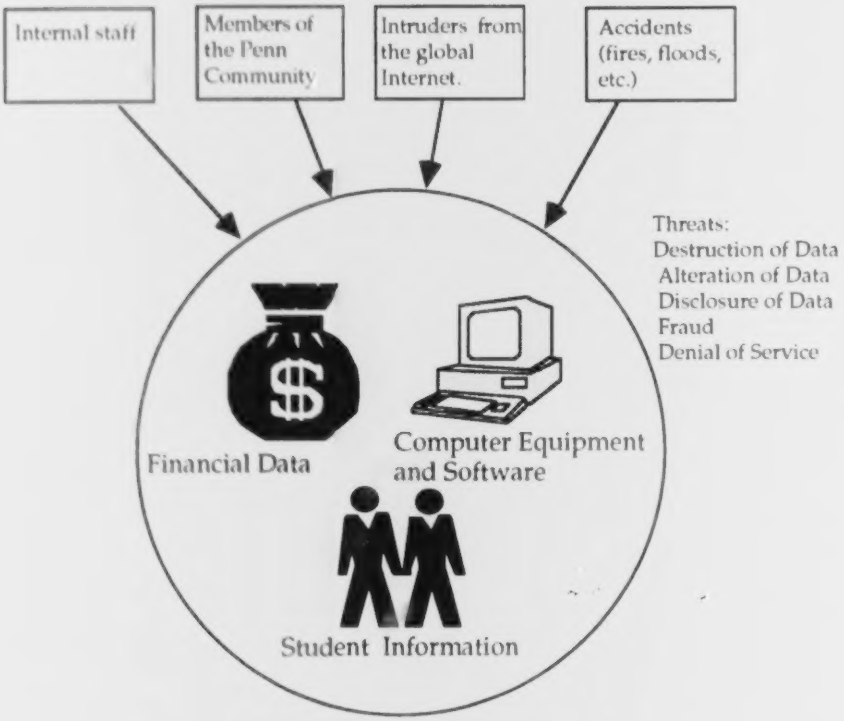
Internal staff
Members of the Penn Community
Intruders from the global Internet.
Accidents (fires, floods, etc.)
Threats:
Destruction of Data
Alteration of Data
Disclosure of Data
Fraud
Denial of Service
Financial Data
Computer Equipment and Software
Student Information

Figure 2 - Assets and Threats

4. **Users Logged in on Unattended Desktop Computer:** *Anyone who comes upon an unattended desktop computer , which is logged onto a server application, has all of the privileges of the user. This problem may become worse as the client/server architecture eliminates the incentive to sign off of mainframe applications to save on connect time charges.*

5. **Employee Fraud/Sabotage:** *Data or programs are altered, disclosed, or destroyed either by a properly-authorized employee abusing his/her access privileges or by an employee who obtains excessive access privileges. Such incidents are more common during restructuring/layoffs.*

6. **Improperly Protected Server Accounts Used to Gain Access:** *Privileged accounts on the server (those with broad capabilities normally only given to system administrators) are targets of intruders for obvious reasons. Poorly protected user accounts , though less powerful, also make tempting targets, since they provide a toehold to gain further privileges. Poorly protected accounts include those with easily-guessed passwords, or no password at all, accounts held by users who write down or script their password for easy sign-on, and dormant accounts belonging to inactive users. An intruder on a server can disclose sensitive information, destroy or*

alter data or programs, and leave behind hidden programs which steal passwords from unsuspecting users of the system, and which make future intrusions easier.

7. **Intruder Exploits Server Vulnerabilities to Gain Access:** *New security vulnerabilities in the Unix operating system and in Internet network services appear almost weekly. Detailed scripts for how to exploit these vulnerabilities are circulated widely within the hacker community, and patches to fix the problem are sometimes not available from vendors for months.*

8. **Privileged Employees Accidentally Delete or Alter Data or Software:** *In performing their duties, an application system administrator, a production control employee,, DBA or system administrator accidentally causes harm.*

9. **Server Destroyed in an Accident:** *Leaking pipes, power failures and equipment failures are not uncommon.*

10. **Address Spoofing:** *Someone spoofs network addresses to gain access to servers, and uses that access to read/alter data or set up future access. Someone "spoofs" a network address by using their host computer to "impersonate" a trusted computer, thereby improperly gaining special permissions and access that only the trusted computer should have.*

11. **Sensitive Data Disclosed Through Packet Sniffing:** *Someone uses a packet sniffing tool (software which allows a computer connected to the network to view data intended for another host computer on the network) to read sensitive data being transmitted over the network.*

12. **Accounts Compromised Through Packet Sniffing of Passwords:** *Someone uses a packet sniffing tool to capture accounts and passwords providing access to the server. In Spring, 1994, the Computer Emergency Response Team reported a high incidence of such attacks, including compromised accounts numbering between the tens and hundreds of thousands CERT recommends that organizations stop sending unencrypted passwords over the network and move to encrypted, one-time password authentication schemes. Extensive harm could done with unauthorized access to numerous users' or system administrators' accounts.*

13. **Network Unavailability:** *Network connectivity unavailable due to accidents such as fiber cuts, flood, fires, power outage, etc.).*

After these threats were developed and articulated, a campus-wide focus group, consisting of both information technology professionals *and* functional managers responsible for the management of processes that use the information assets being protected, reviewed the threats and rankings in detail and suggested changes and additions.

Proposed Solutions

The following solutions were developed and proposed to try to mitigate the serious threats detailed above:

Policy: A comprehensive administrative information security policy should be developed which defines the information assets that the University wishes to protect, and defines the responsibilities of both computer users and computer administrators to ensure protection of those assets.

Server Protection: It is recommended that University administrative computing servers be protected by a firewall. This would allow Penn to better control how they are accessed and used.

Password Hardening: The Kerberos network authentication service was recommended for users of the Data Warehouse and Financial applications. A fair amount of time was spent looking for, testing, and evaluating Kerberos servers and client software. The project team was concerned about vendor support for these products, so commercial versions were evaluated wherever possible. In the end, the team was disappointed by what it found. Commercial products did not have even the most basic features required for a large-scale implementation among a wide range of users.

It was additionally recommended that privileged users will be required to supplement their Kerberos authentication with token authentication. In addition, some users unable to use Kerberos authentication (primarily due to insufficient desktop resources) will instead be required to use a token to authenticate themselves. A token generally uses either a challenge/response algorithm, or a clock-driven algorithm to create one-time passwords, which can not be re-used later, even if they are disclosed by network sniffing. A token authentication server provides token authentication services for the server.

The project team tested the SecureID token extensively and found that it met the project's needs for supplemental authentication. Given the poorer results finding Kerberos-enabled software, consideration is being given to wide-spread deployment of a token card to reduce password exposure even though it does nothing to enable data encryption.

In addition, warehouse users would be required to select strong Oracle passwords using the Braintree SQL*Secure software.

Data Encryption: An additional feature of Kerberized telnet products is the ability to encrypt the full stream of data during a telnet session. Since initially most users will be accessing the financial applications via telnet, this feature is highly desirable. Once again, however, the team could not identify products (commercial *or* public domain) to support these functions to their minimum specifications.

The warehouse users are accessing using client/server products. Oracle's Secure Network Services product is a piece of the Oracle product family that layers on top of SQL*Net and provides end-to-end data encryption with no modification of the client or server application. The project team hopes to deploy it as more financial applications migrate from host-based to client/server.

Desktop Computers: Users storing sensitive data on their desktop computers will be required to protect the data using desktop access control and encryption software unless the computers are otherwise physically secured. Policy should be developed to define the terms and conditions.

Lessons Learned

Be precise with scope: We faced a complex array of security issues to focus on. Product restrictions make it too difficult to select a single solution. Changing requirements blur the focus on the problem. All of the above factors combined demand constant focus on the scope of the project in order to limit the energy to the task at hand (securing the Cornerstone environment).

Stay on top of the vendors: Constant developments in products and technology offered requires constant review of available products that meet requirements. The configuration being secured differs from what other users implemented, hence the vendor requirements differ. This makes it hard to draw on the experience of others.

Limitations of Technology: The technology the project required is just not there yet. Products were usually inconsistent across vendors, and some product families were internally inconsistent. Limitations with the Kerberos components abound. On the other hand, new products are emerging constantly.

The process as an end in itself: Better understanding of how the tested security products work including their strengths and weaknesses. Increased awareness of network topology, network vulnerabilities, and Unix operating system vulnerabilities would be very helpful. The creation of the task force (made up mostly of technical people) and the focus group (made up mostly of business people) greatly increased the awareness of the risks of open systems and client/server computing. The process also helped introduce a risk management philosophy, informing business managers of the technical risks in terms they felt comfortable with. As a result, business managers responsible for applications and data are better able to determine acceptable levels of risk, and to make appropriate tradeoffs.

The recommendations have been presented to the project sponsors and have been accepted where there are products to implement them. Deployment of the firewall has begun. Use of token cards is still being assessed financially. Policy development will begin shortly.

Saving Enterprise Data from the Client/Server Grinch

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Abstract

In the world of client/server technology, where enterprise databases are distributed, how do postsecondary institutions keep from losing control of their data sources? One university's answer was to create an enterprise data infrastructure to ensure the integrity and integratability of enterprise data. The data infrastructure serves as the "hub" of a portfolio of distributed enterprise applications. This paper describes the implementation of the first subject area of the hub, the Affiliate Management System, which contains enterprise data on the organization's customers.

SAVING ENTERPRISE DATA FROM THE CLIENT/SERVER GRINCH

In the world of client/server, where enterprise applications and databases are distributed, how do postsecondary institutions keep from losing control of enterprise data? This was the question asked by Arizona State University's data administration and information technology managers as they observed the outward flow of enterprise data as business units pushed to implement client/server solutions.

ASU's Computing Environment

Arizona State University is a Research I, multi-campus university consisting of three campuses in the Phoenix metropolitan area. Total enrollment exceeds 45,000. The administrative computing environment centers around IBM 3090 MVS architecture. The student information system, developed by ASU, is an on-line and batch application using a large integrated data base (IDMS). The human resources system is a purchased package running on DB2. The university's financial system is also a purchased package running on IDMS, but migrating to DB2 this year. Another IBM product supports electronic mail and FOCUS applications. FOCUS, which was used for end-user reporting and departmental applications, is being replaced by client/server applications. The first client/server implementation was a data warehouse. ASU is exploring other client/server applications in a re-engineering project involving the student information system. Client/server applications use Sybase on a UNIX server.

ASU's Difficulty in Implementing Client/Server Technology

Implementing client/server technology at ASU proved more difficult than promised by industry. Client/server technology is less reliable, secure, and timely than its mainframe predecessor. Networks add new layers of complexity, and monitoring performance and tuning of servers is imperfect. The result is that for complex organizations like ASU, quickly moving mainframe legacy systems to client/server on a major scale may be too difficult. ASU's information and technology managers came to this conclusion re-engineering the organization's student information system. Given the problems in piecing together the new and old technology, ASU realized that mainframe systems were going be around a long time, coexisting with client/server applications until the industry solves some of the problems inherent in distributed and shared computing. For ASU, slowing the pace of client/server development provided data administration and the information technology mangers the time to devise a solution to the critical data problems posed by client/server.

The Need for an Enterprise Data Infrastructure

ASU's information managers view client/server as a desirable computing solution because of the potential for new and improved services for less cost (see anticipated client/server benefits in Table 1). However, client/server also raises many technical, data and security risks. One big risk is that distributed databases and systems will degrade the integrity of enterprise data and lessen the ability of the organization to integrate data between computing systems.

These concerns lead ASU's information managers to conclude that the organization needs a client/server enterprise data infrastructure (EDI). The vision of EDI is that ASU captures the critical enterprise data elements required by *multiple business processes* in a single data model and database. EDI functions as the hub of a portfolio of mainframe and distributed enterprise applications (see enterprise hub at Figure 1). Some of the applications interface with the hub via client/server over ASU's network backbone. Independent systems interface with the hub via program bridges between the two applications.

Table 1

Benefits of Client/Server

- Flexibility
- Potential of Technologies
- Scalability
- Increased Productivity
- Long Term Cost Savings

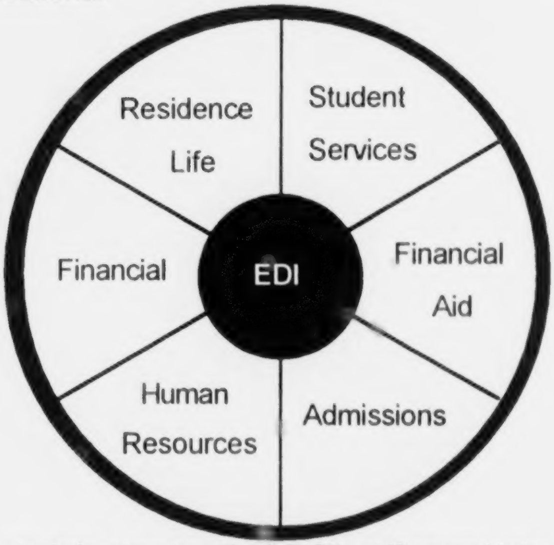

Figure 1. Enterprise Data Infrastructure is the Client/Server Hub.

The advantages of the EDI are many. As ASU implements more and more client/server applications, EDI serves as a seamless data foundation, containing the enterprise data needed by distributed applications. Tremendous economies flow to ASU by managing enterprise data through a single model and updating these data in a single database. Distributed systems benefit by having the most recent occurrence of data, and information engineers benefit by having enterprise formats and standards to guide their work. Through EDI, ASU is banking on improved data integrity, lower costs in updating enterprise data, less data redundancy, and improved services to customers (see benefits listed at Table 2).

Table 2

Benefits of Enterprise Data Infrustructure

- One-stop update
- Data foundation
- Contributes to data integration
- Ensures data integrity
- Distributed developers know enterprise formats and standards

Pieces of ASU's Enterprise Data Puzzle

Advocates of data administration maintain that enterprise data need high-level or corporate management. However, ASU found that defining enterprise data is problematic because almost every data element is "enterprise" to someone or something! In creating ASU's EDI paradigm, data administration and the information technology departments conceptualized not only the data but *what the data were about*. For example, improving customer service is a major goal at ASU; therefore, much of ASU's enterprise data concerns customers.

Following this logic, ASU identified four major subject areas ("puzzle pieces") to EDI: (1) persons or organizations that do business with ASU, (2) work units or departments that comprise the organizational structure, (3) facilities used by both ASU's customers and work units, and (4) programs (academic, research, public service, etc.) that impact ASU's customers (see EDI subject areas at Figure 2). These four high-level subject areas are the foundation of ASU's enterprise data infrastructure. ASU re-designated the customer subject area as the "affiliate" after defining customers more broadly, e.g. students, employees, vendors, donors, constituents, etc. Affiliates are anyone with a business relationship (affiliation) with ASU.

ASU's vision is that through a single model and database, ASU enforces the business rules for the data in each subject area. For example, if an affiliate updates their address, the business rules for address are enforced by the affiliate data model and the update is stored in one location. Distributed or mainframe databases may replicate the address in affiliate, but the update occurs once.

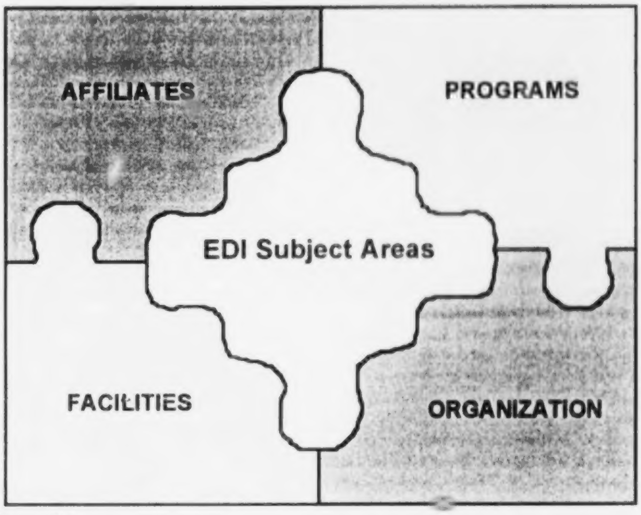

Figure 2. ASU's EDI Puzzle.

ASU decided that the first EDI subject area built should be the area impacting the organization the most. The data administration and information technology departments agreed that the subject area with the most pervasive impact concerns affiliates. This decision was made in part because of ASU's student information re-engineering project. ASU wants to maximize the number of new client/server applications and plans to establish the interface with the Affiliate Data Model from the beginning for these applications. Also, ASU's business units plan on implementing a "single" campus card for all business transactions. The single campus card requires affiliate data services, such as a single affiliate ID for both students and employees. By implementing the Affiliate, the campus card initiative has the ability to interface more broadly with other applications at ASU.

The Affiliate Management System and Its Implementation

The Affiliate Problem

Arizona State University has many business relationships with persons and organizations. Capturing information about the affiliations these persons and organizations have with ASU is an important factor in developing new and improved services. In many cases, ASU affiliates have multiple relationships with the organization which are not understood.

In the past, ASU's business practices and computing systems processed information about affiliates based on the needs of the department and not the needs of the enterprise. Information about affiliate characteristics such as address, name, ethnicity, etc., is captured and stored in different formats using different definitions. When the same data are carried on multiple databases, the data are frequently out of sync with no way to know which occurrence of the data are correct. As client/server technology advances, it is likely that the resulting distributed databases and applications will make this problem worse, unless enterprise data models and policies are implemented.

The end result is reduced levels of service, more expensive systems maintenance, a loss of data integrity, and redundant storage of the same or similar data. However, the most strategic loss is the failure to fully understand the myriad of relationships that a single affiliate may have with the organization. Understanding such relationships could result in a totally new view of ASU and how it serves its customers. ASU hopes another big benefit will be significantly reduced computing and information costs.

The Affiliate Solution

The Affiliate Management System is an enterprise application and data model which solves these problems by defining and capturing in a single data base the attributes and relationships of affiliates that are important to more than one ASU departments. Since affiliate data is stored in a single data base, in a single format, and based on a single definition, the data are more easily managed for the benefit of the organization. When affiliate data are updated, all distributed applications interfacing with the Affiliate System immediately have the benefit of the new information.

The Affiliate System has the advantages common to all EDI subject areas, i.e., reduced maintenance, update and storage costs, and increased data integrity and integratability (review benefits at Table 2). However, Affiliate brings unique benefits by providing ASU a single customer ID that can be linked to other IDs, giving an ASU affiliate the capability of maintaining their "personal" data, making it less complicated for ASU to build applications to support sophisticated customer services (e.g., single-campus ID card) or affiliate to affiliate relationships (e.g., advisor/advisee), and making it easier for ASU to strategically comprehend the full extent of the relationships it's customers have with the organization (see unique affiliate benefits at Table 3).

Table 3

Benefits of Affiliate Management System

- Single ID (could be linked to other Ids)
- One stop update to personal info
- Supports sophisticated services (i.e. mailings, e-mail, fax, etc.)
- Ability to study affiliate relationships with ASU
- Supports affiliate relations with each other

The Affiliate Model

The high-level Affiliate Data Model contains nine entities (see model at Figure 3). The most important entity in the model is the Affiliate. To be an affiliate, a person or organization must have a name and a location (a way for ASU to communicate with the affiliate, i.e., address, phone, or e-mail, etc.). Affiliates are randomly assigned a unique ID which is a permanent identification number. Business units decide when to create an affiliate record. For example, the student recruiting office could decide to create an affiliate record for prospective students or wait until the "recruit" submits an application for admission.

In the Affiliate Model, there are two mandatory relationships between the affiliate and other entities. One mandatory relationship is between the affiliate and an entity called "Affiliation". Affiliations are the "first-order" relationships affiliates have with ASU, e.g., student, employee, donor, vendor, etc. Second-order relationships (relationships which are not mission critical, e.g., a dorm student) are not included in the Model. ASU's data administration and information technology managers believe relationships which exist because of previous relationships are best captured in departmental applications.

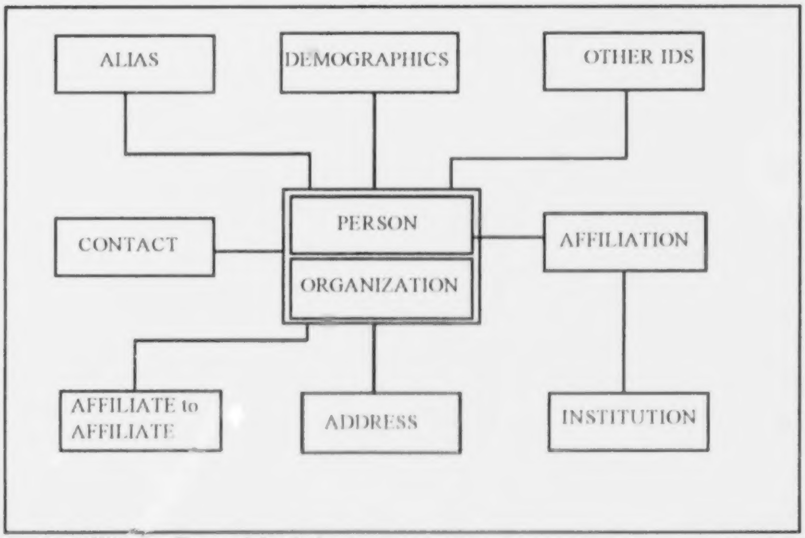

Figure 3. High Level Affiliate Data Model.

A second mandatory relationship exists between the Affiliate entity and Address. In order to become an affiliate, a person or organization must have a way of being contacted by ASU. This may be a mailing, phone call, or e-mail message, but the organization must have a way of communicating with the affiliate. This information is captured in the Address entity, where an affiliate can have multiple addresses, phone numbers, and e-mail locations with differing formats and differing uses.

Alias (other affiliate names), Demographics (ethnicity, birth day, gender, etc.), and Other IDs are entities which may or *may not* exist for an affiliate. These contain data which describe or identify the affiliate to ASU. The entity "Contact" contains information about persons who represent the affiliate. For example, a corporation may have multiple contacts that represent the organization with ASU. In this capacity, these persons are not directly affiliated with ASU, except through their relationship with the affiliate. This is also true of a student's emergency contact. The Contact entity contains the contact's name, address and phone number, and nature of the contact's relationship with the affiliate.

Affiliate to Affiliate relationships is an entity which provides for non-mandatory relationships between affiliates, some of which may be important for ASU to capture. For example, if a group of donors are related in some way, that relationship may be strategically important for ASU to capture. More probable examples are faculty with similar research interests, or advisor/advisee relationships. By capturing this information in the Affiliate Model, it is easier for ASU to build distributed applications which support the business needs that emerge from these relationships.

Only one entity in the Model is related to an entity other than Affiliate: Institution. At ASU, there are three campuses (Main, East and West) which comprise ASU as an Institution. Affiliates can be affiliated with one or more campus, but this relationship only has meaning when the nature of the affiliation is known. This relationship is mandatory so that it is clear what relationship an affiliate has and where (i.e., campus) that relationship exists.

Creating the Affiliate Management System meant that ASU developed new business rules to govern the Model and the data captured by the System. These rules (see list at Appendix A) are still in the process of developing, but do indicate a significant shift in ASU's computing culture.

Data Trustee Program

Building the Affiliate Management Systems resulted in many data issues which are not completely resolved (see list of issues at Appendix B). ASU is creating a data trustee program to manage enterprise data and resolve the data issues posed by client/server. This policy states that a data trustee is assigned to each enterprise data element in the Affiliate Model. The data trustee is responsible for managing these data according to University data policies, including facilitating access and insuring data security. This program is administered by the Data Administration Office. Data Administration selects the data trustee, coordinates communication between data trustees, and facilitates all activities related to managing Affiliate data. Data Administration is the ultimate authority over the use and management of all enterprise data at ASU.

Developing the Affiliate Management System

Phase One (March to June 1994)

The initial development phase occurred as part of a three month pilot project. The purpose of the pilot was to test a new development methodology (Information Engineering), a new development tool (Composer by Texas Instruments), and a new computing environment (client/server). The pilot consisted of developing the Affiliate Model and an application that processed a specific type of affiliate called constituents. During this phase, an overall affiliate model was developed but detailed implementation only included those pieces of the model that were needed for the constituent application. Business analysts from human resources, the registrar's office, institutional research, and data administration participated in the project as well as information technology analysts.

Second Phase (November 1994 to January 1995)

The second development phase included a larger and more diverse group of business analysts with representatives from admissions, financial aid, the graduate college, the registrar's office, sponsored projects, data administration, and the law college. Their charter was to review the "pilot" Affiliate Model, business rules, entities, and attributes and make any modifications needed to implement the model.

Third Phase (May 1995 to May 1996)

The third development phase is to implement the model validated in phase two. This involves completing all entity and attribute definitions, and building windows to maintain what was determined to be "core" affiliate information. The idea is to create a generic application to add and maintain affiliate information, knowing that additional windows will be needed later to enter affiliate information pertinent to a specific affiliation type.

Conclusion

ASU believes that building an EDI is essential if client/server is to produce the benefits promised by industry. The technologists will eventually solve all of the implementation problems of client/server. Interfaces will be smooth and system performance not a problem. What will be a problem is the loss of data integrity and ability to integrate data strategically as distributed applications capture and store enterprise data based on departmental definitions and standards. In building the Affiliate Management System, ASU is hoping to avoid this problem for critical segments of its business. At this point, the jury is still out on whether this approach will work. But be sure to stay tuned for future announcements!

APPENDIX A

Affiliate Business Rules

1. Who is an affiliate?
   An affiliate is a person or organization doing business with ASU
2. What entities and attributes of objects belong in the Affiliate Data Model?
   Entities and attributes of objects belong in the affiliate data model if they are enterprise, common to more than one "business process", and a "characteristic of an affiliate".
3. What is required information to create an affiliate record?
   To create an affiliate record, an affiliate must be separately identifiable, and have a means to be contacted.
4. What are valid affiliation types?
   Affiliation types are fundamental business relationships with ASU that are not concurrently dependent on other relationships. Examples of affiliation types are student, constituent, vendor, employee, and donor.
5. How will ASU format address?
   Affiliate addresses conform to the U.S. Postal Service's format. The affiliate address structure is extremely complex. It allows for multiple address types and multiple addresses for each type. It provides the capability to designate an address as confidential or to be used for a specific purpose, such as mailing grades.
6. What data is excluded from the Affiliate Model?
   Highly sensitive relationships are excluded from the affiliate model to insure the privacy of those relationships. Examples are HIV status, disability, etc.

APPENDIX B

Ongoing Affiliate Data Issues

1. ASU's data administration function and data trustee policies play an integral role in the new client/server environment. These functions and policies are evolving and represent a cultural shift in how ASU's computing community views enterprise data.
2. ASU needs new policies and protocols to insure fair information practices. Since the integration capabilities of the Affiliate Management System make enterprise data more powerful, it is paramount that employees understand the appropriate and ethical uses of the new capabilities.
3. In order to successfully implement the affiliate concept, business units need to agree on data definitions and usage. The user community must abandon the "ownership of data" mentality that characterized past development practices.
4. ASU needs a way to secure certain sensitive or private data in the affiliate database. Due to the nature of the information or the position of the affiliate, some data should not be accessible by the campus community. The client/server environment opens a new set of security issues that were partially resolved in the mainframe world and need resolving in the client/server world.
5. ASU has several large purchased applications that need to interface with the Affiliate Management System. These applications carry name and address information about employees and vendors that must be incorporated into the Affiliate Database. ASU has yet to build the bridges linking these applications with the Affiliate, but is considering data replication.
6. Affiliate information needs to be updated by programs created with different application development tools. ASU needs to maintain the integrity of the data by enforcing business rules about how data is updated. This becomes more difficult when multiple application development tools are involved. The client/server industry needs to address this problem.

UNTANGLING THE WEB

Taking Advantage of WWW Technology

Note: This is an HTML-only track presentation in three segments. For the benefit of the CAUSE95 printed proceedings, the URL's of the three documents are:

- **Title page** http://www.lehigh.edu/~intel/cause.html
- **Untangling the Web** http://www.lehigh.edu/~tjf0/cause95/cause.html
- **Taking Advantage of WWW Technology** http://www.duke.edu/~savage/cause95-summary.html

This track presentation will feature significant present and future WWW development activities at both Duke University and Lehigh University. Taken in total, the session will provide a broad glimpse at creative use of World-Wide Web technology.

In *Untangling the Web* , Tim Foley and Roy Gruver from Lehigh University will discuss how Lehigh University has centrally *supported* the implementation of web-based services. Lehigh's goal is to simplify the development effort for campus constituents, to provide a broad range of information services, and to create a positive external image for the institution.

In *Taking Advantage of WWW Technology*, Bill Savage from Duke University will discuss how Duke has used WWW as an application development environment. Bill will discuss the advantages and disadvantages of the web and will describe how web technology can be used to implement sophisticated client-server database systems.

Presenters:

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Roy Gruver, Lehigh University *(rag3@lehigh.edu)*
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Untangling the Web: Taking Advantage of WWW Technology

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ABSTRACT

For many, the World Wide Web is a place of amazement and confusion. Like a spider's web, its architecture is flexible and its applications are often intriguing and picturesque. Also like a web, applications can exist without much substance, they are sometimes sticky and difficult to navigate, and the links may not connect important parts. Lehigh University has exerted great effort into untangling the Web and using it as an interactive presentation environment. This environment presents a coherent institutional image and a broad range of campus services. A key focus of this paper will be the effort Lehigh has placed on "marketing" WWW: demonstrating its ability to support relatively sophisticated departmental and institutional applications; providing campus-wide development training; involving key departmental partners in early development; and providing institutionally-funded development assistance.

INTRODUCTION

The past half-decade has profoundly transformed the way campuses have conceptualized and developed information systems. The rapid acceptance of client/server technology, and specifically the World-Wide Web (WWW), has created a new paradigm for campus information systems.

Lehigh's implementation of World Wide Web (WWW) technology began as a grass roots effort by a few departments. This seminal effort bore positive results. It also made Lehigh realize that a concerted effort to build university-wide consensus on the value and usefulness of WWW was needed. The process at Lehigh has been referred to as "controlled anarchy", but the results have been impressive -- the entire campus-wide information system is available on the Web; student prospects can "visit" campus through the online Viewbook; numerous departments have created their own homepages with some even running their own WWW servers; hundreds of Alumni have registered under the Alumni homepages and an Alumni Web page has been created to link Alumni to Lehigh from around the world. The Admissions Office feeds web-based prospect information forms into the institutional admissions and recruiting system; Administrative Systems is developing an Oracle-based "virtual kiosk" application for the Web; and they are also working on improving information flow throughout the campus using the online forms facility.

EVOLUTION OF LEHIGH'S INFORMATION ENVIRONMENT

Over the last five years, Lehigh's information environment has been shaped by Lehigh's five-year strategic plan for computing and communications. This plan was developed in the spring of 1990 and finalized in the fall of 1991. The plan called for movement from a mainframe environment to a client/server environment utilizing the Unix operating system. It also stressed the importance of providing high-speed network connections in every office, classroom, and residence hall room. The removal of the mainframes was accomplished with the installation of over 150 IBM RS/6000 computers including numerous high end IBM RS/6000 computers to act as Compute, File, and Communication Servers for the campus. Campus high-speed network connections have been evolving rapidly with major projects underway to connect all offices through the recently established Network Support group. High-speed network connections are also available to all students living in residence halls through the WIRED (World-wide Information Resources in Every Dorm) project which is a joint undertaking of the Computing Center, Telecommunications, and Residential Services. An extensive network of publicly available microcomputers is also in place to provide web access to everyone on-campus.

Another positive force in the evolution of Lehigh's Information environment is the merging of the Information Technology groups with the University's Libraries. Lehigh has always had a strong working relationship between these two groups with many joint ventures such as the installation of over 75 networked microcomputers and workstations in the libraries; the installation and system support of an IBM RS/6000 running the OCLC's SiteSearch software and the Library's web server; the implementation of many tools on Lehigh's Campus-wide Information System that were directly inspired by Library requests; and the installation and support of the Library's on-line catalog system running on an IBM RS/6000.

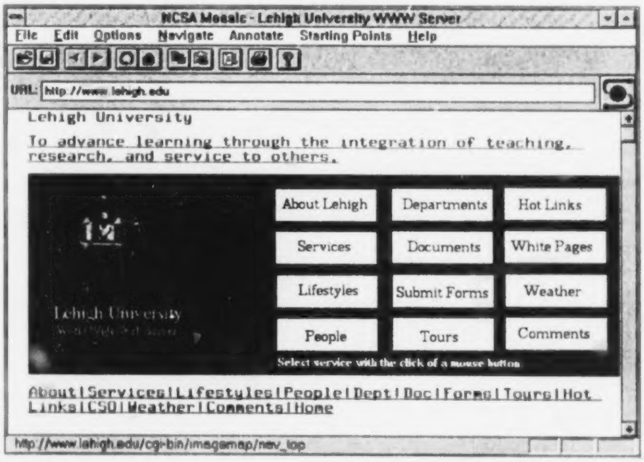
Transforming Lehigh's Campus-wide Information System (CWIS)

Another important element in untangling the web at Lehigh is the transformation of Lehigh's CWIS interface to a web-based interface. Lehigh's CWIS provides the following applications to a user base of over 7000 active accounts: electronic mail, bulletin board and conferencing facilities, access to national and international networks, on-line forms and survey processing, fax delivery and retrieval, and an access point for library services. This system is widely used by the campus with 95% of the community using the system on a regular basis. Lehigh's CWIS was developed in 1986 running on an IBM 4381. The IBM 4381, which utilized flat ASCII files that were accessed by a control file, was replaced in 1991 with a distributed database model using the Oracle database management system on a cluster of RS/6000s. This distributed database model has allowed the client portion of the CWIS interface to run on the web. Faculty, departments, and campus groups automatically have their existing information placed on the web through this Oracle/WWW interface. Lehigh is currently working on improving this interface to provide many of the same features as Lehigh's current terminal-based interface.

Lehigh's CWIS was based on the concept of "distributed services" encompassing both the management and the location of databases and applications. The "distributed services concept has been easily adapted to Lehigh's WWW. Data management activities are the responsibility of individual topic coordinators. Topics on the CWIS are fed, nurtured by, and are the responsibility of, the information providers. Another aspect of distributed services is the ability to access designated hosts or data directories. Distributed applications are being explored to allow selected applications to transparently run on another host. The overall goal is to move from a tightly coupled cluster supporting all available services to a more diffuse system.

MARKETING STRATEGIES

The marketing of the web to the campus community has been an integral part of Lehigh's web strategy. The first web server was setup in November of 1993 with the Computing Center developing a prototype which included an image map (see figure 1) and links to each of these areas. The prototype also included an interactive campus map utilizing scanned images of the campus which were already in place on Lehigh's gopher server. Parts of the existing University catalog were scanned in to develop a hypertext version of the catalog. On the lighter side, experimental pages were developed such as the "Chocolate Milk Guide of the Lehigh Valley" with milk ratings in terms of number of cows. The Computer Store established a web server with a video camera to scan the store's main floor every 60



http://www.lehigh.edu

Lehigh University

To advance learning through the integration of teaching, research, and service to others.

Select service with the click of a mouse button

About|Services|Lifestyles|People|Dept|Doc|Forms|Tours|Hot Links|CSO|Weather|Comments|Home

http://www.lehigh.edu/cgi-bin/imagemap/nav_top

Figure 1 - Original Lehigh University Homepage

seconds and display the image on the web so customers can check if the store is busy before coming to the store. Once this was done, the University's Media Relations group became involved with design suggestions and also by placing on-line many of Lehigh's current publications.

To spread the word of WWW capabilities and provide training to the campus community, a number of initiatives were undertaken. Web seminars were added to the Computing Center's seminar schedule. Separate faculty seminars were also developed which included the use of a digital camera to get faculty pictures on-line and placed on their individual homepages. From the outset, Lehigh's web initiative encouraged individual homepages and also encouraged the linking and creation of homepages for Alumni. Departments were given individual presentations on the value of the web to both the internal functioning of the campus and as a mechanism for presenting Lehigh to the outside world. The President's council and the Board of Trustee were given presentations on the uses of the web at Lehigh and around the world. Special training sessions were given to the Library Staff who also setup their own web server which is linked from Lehigh's main page. This summer, special seminars were given to train one person from every administrative office on the development of HTML documents. These seminars were requested by the Administrative Vice President.

Policies, standards, and guidelines were developed for the web. The issues associated with computing policy are magnified by the ease of use and access to world-wide information through the web. The extensive use of graphics, video, and sound caused concerns about copyright issues and also network bandwidth issues. Policies were in place to manage these issues and are placed prominently on-line. At Lehigh, information providers agree to abide by these policies when web accounts are issued to departments or campus groups. Individuals who create their own homepages must agree to abide by Lehigh's policies before being given an account to create a homepage.

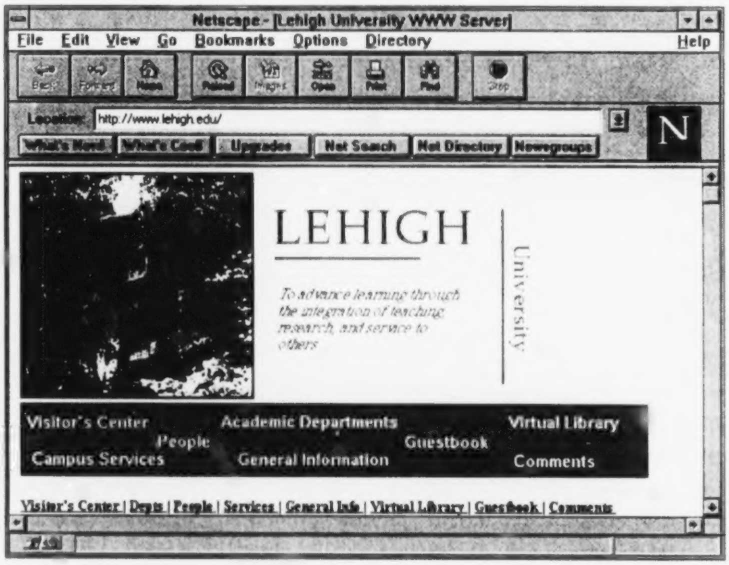
Style guides and suggested formats are made available on Lehigh's web, but departments are on their own to design and develop what they want. The Computing Center decided at the start that departments and groups would be responsible for the design and creation of their individual pages with training provided by the Computing Center. Student Web Authoring Teams (SWAT) have been formed to work with the Computing Center staff and also with individual departments to develop and implement homepages. The departments actually pay for these students out of their own budgets once the students have received training through the Computing Center. A perfect example of this is the work done by one of the SWAT members to place the current University catalog on-line. The SWAT student recruitment process revealed that many students wanted to become involved with creating HTML documents, and the Center had to turn away many qualified students.

Another part of marketing was the tracking of usage and monitoring of comments in Lehigh's guestbook. The usage statistics reveal the global nature of the web, especially when they show that the University's homepage is being accessed by people from around the world on a regular basis. Comments to Lehigh's guestbook such as:

> "Lafayette Class '93. Lafayette 52 Lehigh 20 better luck next time....if it is any consolation your WWW page is the best I've seen"
>
> "Just a senior from Menlo Park, CA , interested in possibly attending Lehigh in the fall of 95. I would appreciate any information you could send me."
>
> " '74 Alumnus. If this stuff had been around when I was there I may have finished my engineering degree instead of switching to Biology"
>
> "Grad Student from Berkeley. I almost went to Lehigh now you have a better homepage than my Alma Mater. Cal."

have been used to illustrate to the University the diversity of the people viewing Lehigh's homepage. It also should be pointed out that Lehigh's guestbook, and also student's individual homepages, have been abused at times and Lehigh has moved from a rather open policy concerning postings to a more controlled environment. For example, last October when the Computing Center was presenting an overview of the web for the entire Administrative wing of the University, looking at the guestbook produced two images of Barney along with a couple links to dating services. Students have posted inappropriate materials on their homepages and have been referred to the Dean of Students for disciplinary action. The entrepreneurial students at Lehigh have also gone into the homepage business to advertise for companies for a charge and they have also set up server sites for distributing adult materials. The student homepage and server issues are covered in the University's Computing Policy.

Another marketing strategy was the involvement of the entire campus in the design of Lehigh's current homepage (see figure 2). It was felt that the campus departments would have a sense of ownership if they were involved in the design and implementation of the University's homepage. This page was designed with input from all departments on campus as to its organization and content. It is currently undergoing another round of revisions and will probably turn into a yearly review task. The amount of suggestions about our current homepage were minimal with most ideas coming from the Computing Center and Media Relations. Other departments were still getting use to the web as a tool for marketing the University and their services. Lehigh's next revision should have more input from other departments as they become more familiar with the web.


Netscape - [Lehigh University WWW Server]
File
Edit
View
Go
Bookmarks
Options
Directory
Help
Back
Forward
Home
Reload
Images
Open
Print
Find
Stop
Location: http://www.lehigh.edu/
What's New!
What's Cool!
Upgrades
Net Search
Net Directory
Newsgroups
N
LEHIGH
University
Visitor's Center
Academic Departments
Virtual Library
People
Guestbook
Campus Services
General Information
Comments
Visitor's Center | Depts | People | Services | General Info | Virtual Library | Guestbook | Comments

To advance learning through the integration of teaching, research, and service to others

Figure 2 - Current Lehigh University Homepage

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And finally, when marketing the web, it is important to get recognition of its value from the highest level in the University as possible. The Dean of the Engineering College has created a homepage for the College and encourage all departments to develop their own homepages. Similar initiatives are occurring at the other Colleges and departments on campus. Lehigh's President has recorded several messages which have been placed at appropriate places on the web. Audio and video players, such as Real Time Audio, are being investigated to provide a better mechanism than is currently available to distribute sound and video. The Center first saw Real Time Audio when the Athletics department made arrangements with Taylor Subscription TalkTM out of Tulsa, Oklahoma to broadcast its football games on the web.

ADMINISTRATIVE STRATEGIES

The creation of virtual kiosks for the University is a high-priority of the Administrative Systems group. The abundance of workstations and PCs connected directly to the high-speed network make the virtual kiosk concept the logical solution for access to student, faculty, and staff information. Students should be able to access their own personal and academic information from anywhere on-campus, especially from their own rooms. Faculty and staff should also be able to access their personal and payroll information through web-based screens. Administrative Systems has explored several different implementations for Lehigh's virtual kiosk and believe that a web-based approach has the most promise. To this end, a number of pilot applications have been developed to demonstrate the flexibility, simplicity, and richness of the web as an application development environment. People from outside the University should also be able to request and receive information. Web-based software that automatically generates mailings and responses is currently being developed. For more than a year, web-based requests for general and admission information have been received from interested students and parents. Further, the web is being used for a repository of operational information and the forms facility has been used to simplify on and off-campus communications.

SUMMARY

The word "web" no longer evokes thought of spiders on most college campuses and one can hear references to it on a daily basis in news and television media. As the web and the Internet have continued to grow at exponential rates people are just beginning to determine the many ways that they can use these new technologies. Cooperation between all departments on campus is essential for providing up-to-date information for both on and off campus users. Training and marketing of the current and future capabilities of WWW technologies is a necessary and daunting tasks that needs to be done to allow campuses to fully exploit the web.

3-8-8

Using Web Technology for Client-Server Database Systems

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Abstract: *Designing, building and supporting client-server database systems is usually a complicated and costly process. Choosing an architecture, tools and vendors can involve considerable risk. World Wide Web (WWW) technology offers an attractive alternative to conventional solutions by providing a simplified and open architecture, often at considerably reduced cost.*

Conventional Architecture

The typical client-server system attempts to enhance productivity and provide timely access to important data by providing a sophisticated graphical user interface (GUI) on the user's desktop. These systems generally provide database access (both inquiries and updates) for client computers which are most often PCs or Macs. Client-server systems utilize a separate server machine, usually running Unix or Windows NT, on which is placed a relational database management system (DBMS). Sometimes a three-tier architecture installs a portion of the application on a third computer positioned logically between the client and the database server.

The client-server architecture usually is based on the bulk of the application residing and executing on the client machine, interpreted and/or executed by proprietary runtime software; PowerBuilder is a prominent example of this approach. Database access is often provided by use of calls to the ODBC library, which are then mapped to an ODBC driver specific to the client platform and DBMS. A DBMS-specific client software layer (such as Sybase Open Client) manages the database access, in conjunction with the network protocol software on the client (such as TCP/IP).

Although this architecture is widely used and supported by many vendors, it introduces issues of complexity, cost, and risk. Some areas of concern are:

- *Vendor selection.* It is difficult to select from among the many vendors of development tools. The tools and languages are generally proprietary and costly.
- *Complicated installations.* The several layers of required client software complicate the process of system testing, installation, and support.
- *Cross-platform support.* Many client-server development products only support PCs running Windows, which is problematic in heterogeneous environments.

Web-Based Architecture

A client-server system can be implemented using a Web architecture. This architecture consists of a web browser (such as Netscape Navigator) running on the client machine, in conjunction with the TCP/IP network software. A web server package (such as Netscape Commerce Server or

NCSA HTTPd) runs on the server machine. The server also includes application programs, implemented in a standard language (often Perl), which are connected to the web server through the Common Gateway Interface (CGI). These programs access the database residing on the server, and dynamically create the graphical interface using HyperText Markup Language (HTML). In a three-tier architecture, the web server and application programs would run on an intermediate machine separate from the database server. Using this model offers these advantages:

1. *Simple architecture.* Because this model is significantly more simple, system installations and updates become easier and less costly.
2. *Platform independence.* The application code is independent of the client platform, as is the language (HTML) used to create the graphical interface. Virtually any client type can be easily supported without system modification.
3. *Standard languages.* Several different standard languages (such as C, C++, Java, Perl and Tcl) can be chosen for the application, thereby removing the dependence on and special learning required for vendor-proprietary languages.
4. *Low cost.* A sophisticated client server system can be built using free software on both the clients and server, including even the DBMS.
5. *Internet Access.* Use of a web-based architecture enables the creation of a system which can be accessed over the Internet. This can be valuable for systems which rely on public usage, or for which remote access would otherwise be difficult.

There are potential disadvantages in some situations when relying on a web-based client-server architecture. Additional planning and expense might be required to address security concerns. The tools and standards are still evolving, and it may not be possible to create a database interface as robust as one created using conventional technology. Because web-based systems are relatively new, it is often difficult to find experienced assistance and good training.

Summary

It is possible today to implement a sophisticated client -server database system using web technology. This web-based approach addresses some of the significant problems that can make conventional client-server development difficult. An increasing number of organizations have successfully adopted web technology in a variety of client-server systems, often with significant cost savings. Web server solutions will continue to gain acceptance as the technology, tools, and standards evolve, and the advantages of this approach become more widely known.

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Coordinator: Mary E. McClure

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Academic Computing Services: MORE than a Utility

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Carleton College

Abstract

The year 1993 saw the birth of a totally new academic computing service organization, and faculty support model, for Carleton College. The result of a campuswide faculty demand for support of information technology use in the curriculum, the model's key elements are: technical support staff with substantial backgrounds and abilities in the disciplines of the faculty with whom they work; faculty "advisors" who partner with the technology staff in supporting faculty technology use; redefinition of "academic computing" as a campuswide, collaborative endeavor; satisfaction of faculty needs as the main arbiter of (a) what support is available, and (b) whether "success" is achieved.

The Carleton experience is consistent with, and validation for, the "quality movement" under way in higher education. "Putting the customer first" has proven an unerring guide in the design of excellent faculty technology support. This experience at the same time is contrary to the current trend toward central technology groups as "utility companies." Carleton has demonstrated that services of a profoundly "value added" nature are eminently and effectively doable by a central computing organization.

Academic Computing Services: MORE than a Utility

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Carleton College

In 1993 a totally new academic computing service organization began operation at Carleton College. An earlier organization had proved not to be well suited to keeping pace with campus-wide faculty demand for support of information technology use, particularly in the curriculum. The essence of the approach of the new organization derives from a redefinition of "academic computing" as a campus-wide, collaborative endeavor in which satisfaction of faculty needs is the main arbiter of what support is available and whether "success" is achieved. This emphasis stems from an understanding that the primary mission of the College is to provide the best education to students that financial resources allow.

Prior to 1993 faculty technology support at Carleton – like that at many colleges and universities – was based on the twin pillars of technology standards and the help desk. Implicit in such an approach is the premise that limiting the number and range of available technologies and the activities of support staff is the best, if not only, way to provide technology support. As Carleton faculty increasingly attempted to integrate technology use into their teaching and research, they found this model to be an inadequate match for their needs which were typically discipline-specific and experimental in nature.

In the past two years a new customer-centered support model has been implemented. The model's underlying premise is that embrace of the full diversity of discipline-based needs and tools and establishment of highly personalized and time-intensive relationships between faculty and support staff will profoundly alter the frequency, quality and impact of information technologies use in teaching and research. The fundamental task of the academic computing organization is to understand what it is that faculty would like to accomplish and then to work with the faculty to select and implement the appropriate information technologies that will increase their effectiveness. This requires that substantial academic computing staff time be devoted to understanding the objectives of individual faculty. Since the ebb and flow of dialogue between faculty and academic computing staff is the central characteristic of this model the organizational structure is designed to facilitate communication.

What two years of data have shown is that the new model has proven an unerring guide in the design of excellent faculty technology support. This experience is highly consistent with, and validation for, the "quality movement" in higher education. The Carleton experience is at the same time contrary to the recent trend toward central technology groups as "utility companies". We have demonstrated, in a remarkably short time, that services with tremendous value-added are eminently and effectively doable by a central computing organization.

I. FACULTY TECHNOLOGY USE: THEN VS. NOW

The profile of faculty technology use after two years of the new support model is vastly different than before: skill levels are higher; overall use levels are higher; curricular use is higher.

Skill and Use Levels

	None	Limited	Moderate	High
Personal Computer				
Skills				
1995	0%	7%	60%	32%
1993	4%	61%	27%	8%
Use				
1995	0%	6%	38%	56%
1993	4%	43%	36%	16%
Word Processing				
Skills				
1995	2%	4%	62%	32%
1993	4%	44%	36%	15%
Use				
1995	1%	5%	44%	49%
1993	2%	37%	35%	26%
E-Mail				
Skills				
1995	2%	15%	54%	29%
1993	49%	38%	10%	3%
Use				
1995	2%	13%	44%	41%
1993	48%	34%	12%	6%
Internet				
Skills				
1995	18%	35%	27%	21%
1993	90%	6%	2%	1%
Use				
1995	17%	34%	27%	22%
1993	91%	6%	2%	1%

Curricular Use

Prior to 1993, curricular uses of information technologies – i.e., uses by students in classes in support of specific curricular outcomes – was rare outside of the sciences and mathematics. Since 1993, curricular computing use has burgeoned within the humanities and social sciences: The percentage of faculty making moderate-to-high use of technology in teaching has quadrupled, **from 6% to 24%**. The percentage using technology in teaching at any level has more than doubled, **from 16% to 34%**.

The following vignettes are representative of the range, nature and scope of technology-based curricular enhancements facilitated campus-wide by the new faculty support model.

BEST COPY AVAILABLE

- Economics: Students are completing senior thesis projects easily equivalent of masters theses. Original research questions are being explored through analysis of vast data sets.
- English: Students are conducting extensive and complex literary analyses through use of electronic texts and sophisticated search engines.
- Biology: Students in several mid-level courses are able for the first time to analyze – not just describe – images from light and electronic microscopes through use of image capture and analysis equipment.

Overall, **one/fifth** of the Carleton faculty have participated in the 2.5 year old "Curricular Computing Grant Program" (more on this program below).

What is most important to see is the change in the overall willingness to experiment with new curricular innovations that use information technologies. The understanding by Carleton faculty that there is help around the corner from technical support staff makes a vast difference in a faculty member's willingness to undertake risky curricular changes. - Scott Bierman

We could have cited "numbers of things" data here, e.g., numbers of computers, numbers of network nodes, numbers of dollars in technology budgets, etc. Such data for Carleton would indeed suggest an "improved faculty technology environment". They, however, would say nothing about increases in faculty abilities and as such would have little point. - Cathy Smith

II. HOW WE GOT HERE:
THE PROCESS OF CHANGING THE NATURE OF FACULTY TECHNOLOGY SUPPORT

The Faculty Task Force on Academic Computing (1992)

In January of 1992 the Dean of Budget and Planning and the Dean of the College called on a group of five faculty, one student, and two administrators to consider computing in the classroom and laboratory, computing in faculty and student research, and computing in academic departments and support services. It was suggested that organizational recommendations would be welcome.

The Challenge: It was understood by all that the College must provide the staff and equipment to make effective use of the opportunities available to enhance the traditional objectives of the College through the use of information technologies. Having said the obvious, the real issue was what organizational structures could be put into place that would increase the likelihood of curricular computing initiatives being employed effectively at Carleton.

It seemed to the task force that the key to getting curricular computing off the ground was to have a structure designed to facilitate communication between faculty and academic computing staff. If faculty could communicate clearly to academic computing staff what their objectives were in their classes, and if academic computing staff could clearly communicate to faculty how information technologies could be used to achieve those goals, curricular computing initiatives would stand a chance. As the task force wrote: *A close knit partnership between faculty members and members of the academic computer staff must be nurtured and encouraged. Effective lines of communication must be developed between everyone interested in academic* *computing. All parties must learn how to utilize the specific strengths that each brings to their joint ventures.*[1]

The Vision: The emphasis from the task force, therefore, was the establishment of a true partnership between faculty and academic computing staff in which the creation of a curricular computing initiative would come about through a dialogue between the two. This dialogue would require that the academic computing staff have good information regarding the objectives and skills of individual faculty members. Obviously, this dialogue would rarely occur as long as the academic computing organization was a standards based, lowest-common-denominator model. Instead the task force proposed a model whose principal features included: (1) cluster departments into divisions based on discipline similarities; (2) provide one professional technology support staff for each division; (3) expect that the technology support staff, including a new director, have division-applicable background in teaching and research as well as technical skills; and (4) identify one faculty member from each division to provide peer and pedagogical support to other faculty.

The task force identified absolutely the right model of faculty support. We thank them for their wisdom! – Cathy Smith

Designing the New Academic Computing Cooperative (January - June 1993)

Planning: Cathy joined Carleton as the new "academic computing director" in January of 1993. Over the following six months, a participatory and collaborative process involving groups of faculty, academic staff and students, and all computing staff, was utilized to define what the new academic information technologies organization would be and do. Within two months, the "Initial Planning Document for Academic Computing" was published. It articulated a vision and mission, and the goals and initiatives for the new academic computing endeavor. The specific goals regarding faculty use of information technologies were:[2]

- Empower faculty to acquire and effectively use information technology for both curricular and scholarly purposes.
- Stimulate innovation in the use of information technology in classroom- and laboratory-based instruction and learning and promote the use of information technology to support the development of new paradigms for teaching and learning.

Staffing and Budget: Based on the Planning Document, staffing and budget requests were developed and submitted. In line with original Task Force recommendations, the staffing request included three staff to serve as the Academic Computing Coordinators for the divisions into which academic departments would be grouped.[3] The staffing request also included 50 hours per week of student work for each Coordinator. A financial model for academic information technologies was developed, and formed the basis for the requested operating budget. A key feature of the financial model was the life-cycle replacement of computer and networking hardware and software. The importance to aggressive and effective faculty technology use of a budget capable of supporting both regular equipment replacement and modest but steady growth in equipment inventories can not be overestimated.

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[1] "Report of the Task Force for Academic Computing", May 19, 1992, p. 2.

[2] "Initial Planning Document for Academic Computing", April, 1993, pp. 5, 9.

[3] The full staffing request, in number of FTE, was: Academic Computing Coordinators, 3; Systems/Network staff, 2; Student Computing Coordinator, 1; Information Coordinator, 1; Director, 1; Clerical/Administrative support, .33. In 1995, a third FTE was added in Systems/Networks. The three Systems/Network staff support *all* central computers and networks, academic and administrative. One hardware maintenance technician in the administrative computing organization similarly services the entire college.

The resulting staff allocation included staff from the previous single campus computing group, and one new FTE. The budget allocation was a combination of an adequate base for year one plus a commitment to build the base over a multi-year period to the levels of the financial model.

Clustering Departments Into Divisions: Cathy, the staff who were to become two of the three faculty Computing Coordinators, and the Advisory Committee for Academic Computing (the committee is described below) spent the Spring of 1993 discussing how the general faculty support model articulated by the Task Force would in actuality operate. First, the three divisions of academic departments were defined. Defining criteria were discipline, curricular and technology use affinities, plus the goal of a reasonably even distribution of clients:

Social Sciences, Performance Arts, & Physical Education

African/African-American Studies
Asian Studies
Economics
Educational Studies
Learning & Teaching Center
Music
Music & Drama Center
Physical Education
Political Science
Sociology & Anthropology
Studies in Theater Arts
Women's Studies

Languages & Humanities

Academic Development & Support Center
American Studies
Asian Languages & Literatures
Classics
English
German & Russian
History
Judaic Studies
Media Services
Media Studies
Modern Language Center
Religion
Romance Languages & Literatures

Natural Sciences, Mathematics & Art

Arboretum
Art & Art History
Biology
Chemistry
Geology
Linguistics
Mathematics & Computer Science[4]
Physics & Astronomy[5]
Psychology
Dean for Budget & Planning[5]

Defining Support Services: Then, "every conceivable" support activity and variation on it was analyzed by the group: What benefit did each provide, and how critical was this? What level of the Computing Coordinators' time and effort did each require, and did the "payoff" warrant it? This dialog, by clearly identifying the costs and benefits of all possible support functions, generated a highly realistic set of support services priorities. Three support priorities emerged from this process:

- The ability of Computing Coordinators to spend large amounts of time interacting with individual faculty and exploring technologies on faculty's behalf

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[4] It should be noted that these two departments each hired one computer support staff some years ago. The Coordinator for the division is nonetheless very active with these departments; the bulk of faculty assistance it met by the departmental support person, however.

[5] This obviously administrative department is supported by academic computing because it is the office to which academic computing reports.

- The ability of Computing Coordinators to assist individual faculty with the development and delivery of computing and networking uses in the classroom
- Faculty freedom to choose, and be supported in using, a wide range of software

In light of these priorities, examples of service tradeoffs were:
The Coordinators would often be away from their phones. Faculty expressed a strong desire to be able to interact with professional rather than student computing staff. Conclusion: A "help desk" – where someone is guaranteed to be available to answer telephones during defined business hours – would not be among the set of faculty support services. Resulting service profile: Someone will not always answer the phone, but when the phone is answered, resolution is basically guaranteed.

Formal computer training curricula and good computer documentation require very large amounts of time and effort. Could the Computing Coordinators develop and maintain a curriculum and local documentation *and* meet the three service priorities? *No.* Conclusion: Neither a formal computer training curriculum nor a program of local documentation would be among the set of faculty support services. Resulting service profile: Faculty receive individualized "training" upon request. Interactions with Coordinators are the vehicle for much, if not most, learning. Vendor manuals are distributed with all equipment and software, and Coordinators make it a practice to engage faculty with their manuals in consulting situations.

III. THE NEW ACADEMIC COMPUTING COOPERATIVE IN ACTION (JULY 1993 - PRESENT)

The Academic Computing Coordinators

The three Computing Coordinators have the combination of technical and discipline-specific backgrounds defined as ideal during the planning process. One is a Classicist and language specialist; the second, a Political Scientist and quantitative methods specialist; the third, a Physicist, specializing in numerical and laboratory techniques. Our experience has confirmed that, in order for the Computing Coordinators to partner with and support their faculty in the ways and extent envisioned by our model, it is absolutely imperative that they have academic backgrounds, and remain actively engaged in the issues of teaching, learning and research.

Such a staffing approach can present challenges. For instance, these individuals can be hard to find. It can not be assumed that individuals who have been successful in traditional faculty technology support roles will do well in our non-traditional model. Where, then, does one look? We have successfully recruited two Computing Coordinators from the growing ranks of graduate students in love with the possibilities of technology in teaching and research as well as their academic disciplines. The recruitments have taken longer than those of more traditional staff, and have required a high level of active searching and soliciting.

Though the Coordinators are characterized as technical support staff, if required we will sacrifice technical skills to academic ones during recruitment. Whereas an individual can build technical skills over time – and while they do, other staff in the organization can help out – s/he cannot undertake, or redo, an entire career as a student, graduate student, teacher and researcher.

How Academic Computing Coordinators Interact with Faculty

Computer Delivery and Set Up: A Key "Bonding" Experience: The Coordinators and their student assistants set up the computers of their clients. After installing and testing hardware and software in our "bench" area, they then install the system including network connection in the faculty office or lab. At that time or others of faculty choosing, they also provide one-on-one training on the use of the system and application software.

Software "Standards": This seems like a good point to talk about the issue of "software standards". Within budget constraints, the choice of applications software installed on a system is the user's. What this has meant in practice is:

- Word processing, spreadsheet, file management, presentation, graphics – The range of what faculty currently want and need includes approximately six word processing, three file management, three spreadsheet, two presentation, and three graphics programs.
- Faculty require a large variety of discipline-specific applications. We have successfully met these needs by the process through which departments and academic computing collaboratively determine the computing equipment needed within the department through yearly analysis and planning, and by the establishment of key site licenses.

We acquire and provide assistance with the range of applications needed and used by faculty. Our support philosophy is that simple.

Moving from the prior software standards-based environment to an approach that focuses on what it is that faculty need to be able to do has resulted *not* in chaos and pandemonium, *but rather* in faculty having the applications they need and with which they feel comfortable and will achieve new outcomes in their teaching and research.

"Computer Delivery" is therefore a very pivotal occasion for faculty and computing staff to establish what will be an ongoing relationship of highly personal and individualized support. Because the software and hardware being installed has been selected on the basis of faculty needs and preferences, installation is a time of mutual excitement and anticipation, a time when faculty and computing staff begin to explore possibilities together.

Training: The Computing Coordinators and their assistants provide one-on-one training to faculty upon request. The request is often the result of a Coordinator suggestion that s/he could show/teach a particular topic or skill. Training content and scheduling is determined by client need; the training usually occurs in the faculty office, on the faculty computer. Small group training has also been utilized for networking topics as networking initiatives usually occur at the department level.

Curricular and Technology Research: The question we particularly hope for from faculty is of the form, "Is it possible to....". We earnestly want faculty to express any/all ideas on possibilities for curricular enhancement. Such ideas do not necessarily contain a technology component at the outset. The ideas do provide a basis for discussions between faculty and their Computing Coordinators (and their Faculty Advisors as detailed below). The ideas are poked, prodded, expanded, and clarified. Based on the discussions, the Coordinators may conduct research in a myriad of areas – e.g., what is being done in like courses at other institutions, what technologies may particularly support the curricular goals – through a myriad of resources – e.g., Internet resources, cohorts at other institutions, periodicals, technology vendors, etc. The process is then an iterative one of refinement through successive discussions and information gathering, typically including the hands-on examination of software an/or hardware. When the research process concludes, an idea is sorted into one of a few categories: non-starter; infeasible at this time; great idea; let's pilot it.

Curricular and Technology Pilots: A pilot is an experiment: Will the desired curricular enhancement materialize through the introduction of technology use and other changes within a syllabus, and at what costs? Pilots involve at least introductory mastery of a technology by the instructor and some student use as part of their course work. The Computing Coordinator's role is to provide full and direct assistance at every step; faculty training, software and hardware preparation and testing in our student computing environment, student training, and trouble shooting and analysis. (Successful pilots are then systematically integrated into departmental curricula, the student computing environment, and the academic computing budget.)

It is very important for faculty to have frequent contact with the Coordinator. It is rare that a conversation I have with my Coordinator begins with "Is it possible to...", more often it consists of some seemingly mundane problem that I am trying to jury-rig a solution to. From there my Coordinator will ask me what I am trying to accomplish and twenty minutes later we are embarking on a far more ambitious and intelligent plan of action. Because of the value of these conversations I have made it a point to call on my Coordinator at least once a month whether I need her help or not. While these are intended to be social calls they invariably turn out to be extremely productive as well. - Scott Bierman

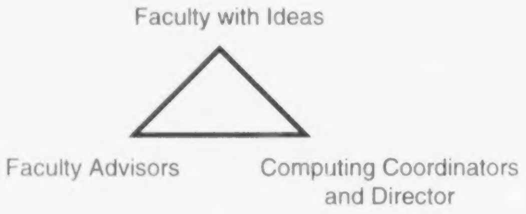
The Relationship Between Academic Computing Coordinators (ACC) and Other Academic Computing Staff

Student Assistants: Each Computing Coordinator recruits, trains and supervises 3-5 student assistants. Assistants perform the functions and tasks delegated to them by the Coordinators. Student Computing Coordinator (SCC): The SCC Manages student computing sites. The SCC is solely responsible for generic and general purpose offerings of student sites; the ACCs share responsibility for course- and discipline-specific offerings. The SCC manages and maintains computer classroom facilities; the ACCs train faculty in use of computer classrooms, participate in first classroom session(s), and remain on-call to provide faculty assistance thereafter. Systems/Network Staff: Systems staff manage central computing resources; ACCs perform account and volume management for their users. Network staff design, manage and maintain network cabling and electronics up to the wall jack; ACCs install network cards in faculty computers, and connect to the wall jack. Network staff select and define standard configurations for network software; ACCs install and support network software on faculty computers. Information Coordinator (IC): The IC develops local timesharing system documentation for students; the ACCs also distribute this documentation to faculty. The IC manages the campus WWW server and academic computing's web content; the ACCs and assistants develop and maintain academic department home pages. The IC sits on CWIS oversight committee; one ACC also sits on CWIS committee.

Desktop Hardware Maintenance: ACCs attempt to diagnose hardware problems, and effect those repairs which consist of replacing parts. Diagnoses and repairs beyond this are passed to the campus hardware technician (see footnote 3).

Faculty Advisors

There are three "Faculty Advisors for Information Technology" at any time. A Faculty Advisor is intended to be an advocate and counselor for other faculty wishing to make further use of information technologies in their teaching. A Faculty Advisor is not a "technology super person", but rather someone who is comfortable with technology, uses technology in the classroom, and is willing and enthusiastic about talking with cohorts regarding the costs, benefits, and pedagogical issues of curricular computing. One member of the faculty from each division is invited to take on this role. The commitment is a three year one, and a 1/6 course release per year is offered as remuneration. The Director and Computing Coordinators work in close collaboration with the Faculty Advisors. Faculty Advisors are involved in the curricular discussions, research and piloting discussed above:



Curricular Computing Grant Program

The establishment of a competitive faculty grant program was among the very earliest objectives cast for the new academic computing organization. The program was launched in the spring of 1994 with the simple goal: *Curricular Computing Grants are designed to enable faculty to explore, experiment with, and pilot the use of information technologies to enhance their teaching. The goal is the improvement of educational outcomes.*[6] Possible awards include stipends for times when the College is not in session, software, hardware, fees for training, data, etc., and in exceptional cases, course release. Grants have been awarded to 35 faculty in three years; this represents (an amazing) 20% faculty participation rate.[7]

This program has been the vehicle through which most of the curricular computing ideas, discussions, pilots and adoptions have occurred. It is therefore the coalescence point of the goals of the new computing organization, the role of the Computing Coordinators, and the role of the Faculty Advisors.

The program has provided us with a comprehensive, consistent and ongoing means of curricular innovation. It is not clear that we would have accomplished so much, so quickly, without it.
- Cathy Smith

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[6] "Curricular Computing Grants: Guidelines for Proposals", revised September, 1995, p. 1.

[7] Check http://www.carleton.edu/campus/ACNS/CAUSE/cause3.html for a list of the Curricular Computing grants

As much as anything the Curricular Grant Program has provided an institutional stamp of approval for faculty to spend time on curricular initiatives. Now, finally, was a recognition that it is time consuming to modify curricula to take advantage of information technologies and that the time spent doing so is valued by the College. - Scott Bierman

Advisory Committee for Academic Computing

The Advisory Committee for Academic Computing is made up of the academic computing director, the Faculty Advisors, an Associate Dean, one staff member from an important academic support unit, and one student.[8] The Chair of the committee is one of the Faculty Advisors and works closely with the Director to establish an agenda. The committee performs five important functions. First, it provides a venue for discussion concerning long-run information technology planning such as establishing network upgrade priorities, identifying potential needs for additional staff, and developing incentives for curricular technology use. Related to the first function is the second, to set budget priorities. The committee uses information from departments about their long-range plans to help establish the direction of broad categories of expenditures. (It is left to the Director to manage budget specifics, including annual departmental allocations.) Third, it serves as a policy discussion forum. As elaborated elsewhere, all decisions on the basic forms and nature of faculty technology support are set within the committee. Issues such as usage privileges are also determined. Fourth, the committee members are campus-wide advocates of the importance of information technology in the curriculum.

The Advisory Committee is by no means a "watchdog" group. We are partners and friends, sharing a role in guiding academic information technology development and use at Carleton.
- Cathy Smith (seconded by Scott Bierman)

What Faculty Think of Their Computing Support

You've got a wonderful crew over there and I am so very pleased with the "attitude" of your staff. If everyone on the campus were oriented the way you run your operation we would all love each other and usual conversation would come to an end.
- Charles Carlin, Professor of Chemistry and President of the Faculty

Not only has the creation of ACNS provided me with the support to implement curricular dreams, it has also led to new inspirations that would have been impossible without the stimulating interactions between faculty and ACNS staff. Our academic computing infrastructure seamlessly interweaves the technical and pedagogical strengths of ACNS staff and faculty with incredible curricular outcomes for our students.
- Susan Singer, Associate Professor and Chair, Biology

ACNS has come to our aid much more vigorously and in a more timely way than ever happened under the old setup. It is great to know that we have truly expert people ready to come to our assistance.
- Kirk Jeffrey, Professor and former Chair, History

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[8] There is a separate advisory committee which focuses exclusively on student computing issues.

Adam Smith argued in The Wealth of Nations that division of labor was the prime determinant of a nations growth. What the economics department has learned is that division of labor, combined with good communication between faculty and ACNS staff who view themselves as partners, is the way to provide the best education to our students.

- Scott Bierman, Associate Professor and former Chair, Economics

IV. WHAT HAS NOT WORKED AS WELL AS IT COULD OR SHOULD?

Handling All Levels of Support

In the first year of the new organization, the activities involved in training and developing the confidence of faculty with low skill levels left the Humanities and Social Sciences Coordinators time for little else. The result was that not as much exploration of curricular possibilities as was envisioned and desired occurred. In year two, we hired a one-year "Faculty Support Intern", and her presence meant that these basic support activities no longer dominated the two Coordinators lives. While the intern accomplished what we desired – raising the skill levels of large numbers of faculty – we are currently wrestling with the notion that we may need an intern, someone to take care of the "lower, more mundane " support activities, every year.

While faculty generally understand and agree with the notion that the Coordinators need to be "out and about", it is of course painful for them to have "a crisis" when their Coordinator is not immediately reachable A seemingly unrelated problem... The Coordinators don't get/take as much time as they need to read and learn new things. Why? They are never "off line". The solution, we hope, to both problems will come with the unveiling of *Quickline* in January of 1996. One of five professional staff will answer the Quickline at all times. Because they know faculty will not be left in the grips of an emergency, the Coordinators will now be able to go off line in order to read and learn.

Old Mind Sets Die Hard

Though there is widespread agreement (dare we say, amazement) that so much has changed so profoundly so quickly, we are periodically reminded that years of attitude setting and settling take a long time to overthrow. A few faculty still do not know that they can get the assistance they want/need. Others are reticent "to impose" on their Computing Coordinator for personal attention. The needs- and value-based resource allocation process is not necessarily comfortable to those who used to assume that a certain level of resource was automatically forthcoming because of department of discipline. There are occasional, though rare, staff lapses into a "Don't they know we can't do that?" response to a faculty request. *There's no such thing as too much communication.* - Cathy Smith

Nothing Succeeds Like Success

Faculty desire for technology and technology support services has skyrocketed. We continually strive to do more in order that no needs go unmet. This of course is a source of stress, but stress fortunately balanced by our lengthy list of contributions to the improvement of the educational experience at Carleton.

V. ARE THERE THINGS TO BE LEARNED FROM CARLETON'S EXPERIENCE?

We believe that our experience definitely offers proof that defining services and success *from the faculty's perspective* results in satisfied faculty, high technology skill and use levels, increased and effective curricular technology use, productive technology use, and high return on institutional investment in technology and technology support resources. Central, campus-wide technology organizations *can* provide value-added, customized services.

What is the relationship of institution size to ability to provide such services? One may assume that Carleton can marshal its faculty support model because it is "small" (approx. 1800 students, 180 permanent faculty). We are small. More to the point, however, is the fact that the College increased professional faculty support staff by 200% (and student staff by roughly 100%) in order to re implement faculty technology support. This is a *very* significant increase in investment. It represents the institutional will to maximally leverage information technologies in the evolution of the curriculum, and the institutional commitment to all faculty that they *will* be empowered to effectively utilize increasingly essential information technologies. We believe: the support-staff-to-faculty ratio upon which our model is operating (1 to 60) can be replicated/approached by institutions of all sizes if the institutional will exists; in many institutions, it is staff re-deployment from decades old service philosophies and staffing models, not increases in staff numbers, that are required; all institutions should adopt a similar model if not for all faculty, at least for those who will otherwise be left out of an academic world that has become dependent on technology use.

How much of our "result" is accounted for by structure? By the individuals working within the structure? We obviously believe that the formal model and organization we are using lead to desired outcomes, and therefore encourage others with similar aspirations to consider adopting similar approaches. On the other hand, it is very clear that we would not have the same outcomes we have without a set of individuals inspired and motivated by, and overwhelmingly committed to, our vision and goals.

After the first year of the new model, we had enough of a "track record" that other institutions desiring to redo their methods of faculty technology support began to seek us out. A number have made site visits; all are adopting at least some of our strategies. A foundation has thought well enough of our new approach to provide grant support.

The value of information technology in the education of college students depends on faculty taking the initiative to alter their teaching methods. Faculty have a good idea of where they would like students to end up but often only a limited notion of how information technologies can get them there. Computing service organizations know what technologies exist but have a limited sense of what specific faculty ultimately want to achieve. Hence computing service personnel must work hard to understand what faculty are trying to achieve in order to be proactively helpful. And faculty must understand that computing service staff are important partners in the goal of providing current and future students with a top-notch education and aggressively seek their advice. Without this partnership and mutual recognition of each other's role neither the faculty nor the computing organization will effectively implement information technologies into the curriculum.

ACT--Get Your ACT Together

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ABSTRACT: *Ball State University has been a statewide leader in welcoming students and staff personnel with special needs requirements. The Office of Disabled Student Development has provided a full time coordinator who was charged with the responsibility of removing architectural barriers and to assist in providing the best possible learning environment for all persons attending the University regardless of individual disabilities. Through these efforts the University has been recognized at both the state and national level for initiatives in this area.*

GAINING CAMPUS SUPPORT

Ball State University has been a statewide leader in welcoming students and staff personnel with special needs requirements. The Office of Disabled Student Development has provided a full time coordinator who was charged with the responsibility of removing architectural barriers and to assist in providing the best possible learning environment for all persons attending the University regardless of individual disabilities. Through these efforts the University has been recognized at both the state and national level for initiatives in this area.

During the mid 80's Ball State University began a computer competency program aimed at producing a graduating student population which was both knowledgeable and competent in the use of computing technology in their major area. During this period a concentrated effort was made to include all students, faculty, and staff including those with disabilities. As the program advanced it became evident that a full time coordinator of Adaptive Technology would be needed to deal with grant funding, affirmative action for potential employees with disabilities, special student needs in the area of technology and other legal requirements. This was, as most of you know, a time when the state legislatures were not interested in funding new positions, and our President was not in favor of adding professional staff. This, then, is how Ball State University funded a new full time position and established the Adaptive Technology Program as it exists today.

When President George Bush signed the Americans with Disabilities Act [1], he said "Let the shameful wall of exclusion finally come tumbling down". The legislation took effect on January 20, 1992 and afforded Ball State University the opportunity to focus on the issues of providing proper support in the attempt to provide accessibility to our disabled students, faculty, and staff. Having previously dealt with the problem of architectural barriers Ball State was in a position to concentrate on the technology portion of the issue and how best to meet the needs of the University population. A small coalition including the directors of computing, disabled student development and affirmative action decided to leverage this high interest level into a program of enhanced services and technological infrastructure.

The Rehabilitation Act of 1973 prohibits discrimination against the handicapped within any institution that receives or benefits from federal funds. Being handicapped was defined as "one who has a physical or mental impairment which substantially limits one or more major life activities, has a record of such impairment, or is regarded as having such impairment." Major life activities include: self-care, social life, education, transportation, housing and employment.[2] With regard to higher education, a qualified handicapped person is defined as one "who meets the academic and technical standards requisite to admission or participation in the recipient's program or activity." [3] An institution of higher education receiving such funds "shall take such steps as are necessary to ensure that no handicapped student is denied the benefits of, excluded from participation in, or otherwise subjected to discrimination under the education program or activity operated by the recipient because of the absence of auxiliary aids for students with impaired sensory, manual, or speaking skills."[4] The Americans with Disability Act further required that each service, program or activity conducted by a public entity "when viewed in its entirety" be readily accessible and usable by disabled individuals.[5] This provision specifically dealt with printed materials whether in syllabus form, supplementary reading lists, and tests which must be made available to students in a format which allows the student to display their ability and to allow for an evaluation which centers on ability and not disability. Braille and electronic reproduction are frequently given the foremost consideration.

Educom has estimated that over 10% of all college students have some form of disability. Current estimates place the number of Americans with some form of disability at 43 million. This includes the 4.5 million students currently in our school systems. These include 40% with some form of visual impairment, and 26% with some form of hearing disability.[6] As employment opportunities for persons with disabilities we can expect an even greater number to be attending the nation's colleges and universities in the future.

The refocusing of issues caused by the ADA gave the University the opportunity to make "formal" a program previously staffed by volunteers. The timing and synergy generated allowed the establishment of a program budget supported by funds from the offices of the Provost, President, and V.P. for Student affairs. This budget allowed the university to hire the first full time coordinator of adaptive technology. The University Computing Services budget provided funds for the hardware, software, and supplies to start the Adaptive Computer Program (ACT) and this in turn has generated grants and other gifts which permitted a significant leveraging of the initial investment.

BUDGETING AND RESOURCES

In the university structure this program is unique in having multiple offices sharing the fiscal responsibility. The newly appointed coordinator was allowed to select the hardware and software and these items, in addition to the several items previously purchased by the departments of Computer Science and University Computing Services comprised the beginnings of the new program. The coordinator provides a yearly request for hardware and software which is prioritized by areas of need. Most of these purchases are taken from the University Computing Services budget but it is not uncommon for special needs to arise during the year which are unanticipated and which are supported by other university departments.

The position taken by the University is that providing access to technology is a University function and as such should be funded cooperatively by the areas affected. We feel that this willingness to share resources among departments sets Ball State University apart somewhat from the norm. The ADA specifies that certain accesses shall be provided by the university and so the university funds certain of these through the central administration. Other requirements made during the academic year might be funded by a department or through a cooperative sharing of resources. This sharing precludes the need to "own" the service or technology provided. It is just such willingness to provide rather than to own which has made the program so successful.

Under normal circumstances it is within the purview of the Purchasing department to secure pricing and negotiate with vendors, however, due to the extensive background and knowledge base of the director a great deal of latitude has been granted in this area. By virtue of having an extensive technical background the Coordinator has been able to request and obtain certain configurations of hardware and software which have been particularly successful in solving problems with providing access to University technology In some cases vendors have willingly given discounts on items which were used in special applications in exchange for the feedback generated. This has turned out to be a win-win situation for both the vendor and the University.

We still continue to do Beta testing for both hardware and software vendors. This cooperation has resulted in a number of applications which are currently being used and refined and which benefit both the vendor and the user as these refinements result in more sophisticated solutions to accessibility problems. The main recipients of the benefits thus created have been the students which have gained a degree of accessibility that might have otherwise been unavailable to them.

All of this is a reflection of the attitude of the University in responding to the needs of the students. Money and space are two items which are normally held sacred to a budgetary unit within the University. Ball State has been successful in breaking down this tradition with the attitude of sharing and cooperation. This has allowed us to not only follow the letter of the law but to exceed its expectation to the benefit of the students and faculty.

ACT PROGRAM SPECIFICS

The pervasiveness of computers and electronic information systems which has developed within the last few years has been met with a degree of apprehension by the "technophobes" within the general population. Much of the disabled population has, however, embraced the new technology as a means of increasing their independence and functionality. The integration of hardware and software systems which are designed to meet the needs of those individuals with disabilities is the crux of the adaptive computer technology program. Screen reading and optical character recognition software combined with voice synthesizers and scanners allow visually impaired individuals freedom of access to texts, journals, and other documents that permeate the collegiate atmosphere. Keyboards which are specifically designed for students with disabilities combined with voice recognition technology and artificially intelligent word processing software help mobility impaired students prepare their class assignments, term papers, and other requirements for the successful completion of their course work. Intelligent communications software enables the hearing impaired individuals to converse with others through the telephone without the need for interpreters. These adaptive technologies continue to break down the logistic and time barriers which persons with disabilities face on a daily basis.

Close cooperation and a clear sense of direction are required if the program is to be implemented successfully. The ACT program at Ball State University is directly involved with fulfilling the goals and mission of not only University Computing Services, but those of the University in general. The ACT coordinator works closely with the heads of the academic units to ensure that the departmental educational objectives are facilitated for students with disabilities within specific major areas of study. Technological resources provided by Media Services, University Libraries, and other non-academic areas are utilized as required to provide effective access to the information necessary for a successful educational experience.

The University mission statement charges that we produce graduates who are "able to analyze information, think critically, solve problems, communicate effectively, and demonstrate competency with computers."[7] Students with disabilities are continuously faced with informational access barriers. The ACT program facilitates access to information, thus allowing the students to play an active role in planning and implementing specific adaptive measures which target individual needs. The ACT training further provides students with a foundation in computer literacy as well as advanced usage techniques. Access to documentation resources allows students to become both knowledgeable and independent. This program also provides disabled students with the knowledge and ability to solve information access problems that translates directly to employment situations which will be faced after graduation.

"BALL STATE UNIVERSITY 2000" is a list of goals and objectives with which the ACT program is also concerned. This list was prepared by the University faculty and administrative staff to launch the University into the twentieth century. The ACT program is actively involved in producing graduates which are sought by employers and graduate and professional schools by providing them with the tools necessary for effective access to information and technology. Work experience opportunities are provided through the ACT lab assistant and management positions. The program Coordinator consults with employers who provide internships which address and resolve accessibility issues. The ACT Coordinator consults with faculty to devise strategies which will ensure access to course materials. Emerging adaptive technologies are continually investigated and evaluated so that we can provide the most effective access possible. Students are encouraged to take responsibility for their education and to work with adaptive technology as a means to pursue their individual educational goals.

Through consultation with primary and secondary educational institutions programs are designed that ensure a proper foundation in basic technique is provided for students with disabilities who plan to continue with post secondary education. Accessibility issues concerning distance learning opportunities provided by the University are also addressed by the ACT program Participation in recruitment, orientation, and preparation of prospective students has made Ball State University a leading provider of accessible educational opportunities to persons with disabilities.

This program is a direct extension of University Computing Services. UCS is charged with "offering a wide range of computing and systems services to students, faculty, and staff. University Computing Services strives to provide those within Ball State University with the equipment and services required to complete their respective objectives."[8] The program exists to provide access for disabled students to the general services provided by UCS. The program further allows access to the mainframe system, as well as resources provided by individual department computer labs. Internet services are also facilitated by adaptive technology. UCS provides the services while the program gives students with disabilities access to the services.

Specifically, the program's mission is to provide "equal access to computing services to all persons with disabilities at Ball State University." This is accomplished by direct education of students as well as faculty development efforts aimed toward making course work accessible for disabled students. The program provides reasonable accommodation for students, faculty, and staff with a wide array of equipment and supportive services by enhancing existing academic and computing facilities. This is done in accordance with the University mission, computing Services mission, Public Law 504 and the Americans with Disabilities Act. The mission of the Adaptive Computer Technology Program at Ball State University is, therefore, a synthesis of all these missions. The University provides the philosophical impetus, while UCS provides the technological base.

The Adaptive Computer Technology committee was established in 1990 to facilitate the communication between various units of the campus which were involved with disability issues as well as faculty, staff and students with disabilities. Membership includes, but is not limited to, the Directors of University Computing Services and Disabled Student Development, Coordinators of University Computer Labs, University College Learning Center and Adaptive Computer Technology, Assistant Dean of University Libraries, Chairperson of the Computer Science Department, Media Services personnel, Indiana Vocational Rehabilitation regional management, and a representative from each of the four predominant disability populations on campus. Members are responsible for long-range planning, unit requests for services, budget proposals, and dissemination information to individual campus units. Although the ACT committee is considered an ad hoc delegation, the University-wide Americans with Disabilities (ADA) committee has been kept apprised of proceedings and developments. The ACT committee has six meetings a year with impromptu meetings as needed to insure continued commitment to the ACT mission.

The ACT coordinator is responsible for maintaining the adaptive hardware and software which is located in various labs throughout Ball State University and for those faculty and staff who have adaptive technology allocations. Requests for adaptive services are directed to the Coordinator, and equipment and resource allocation decisions and logistics are supervised by the ACT Coordinator. The Coordinator is also responsible for resolving all information accessibility issues which occur at Ball State University.

Familiarity with advances in the field is another important aspect of this position. The ACT Coordinator anticipates the needs of clientele with disabilities and is responsible for acquiring and implementing new technology, configuring and integrating new technology with existing systems, authoring grant proposals, beta testing products and studying the feasibility of new adaptations. Training sessions and workshops are routinely conducted to ensure the equipment and software is used properly and knowledgeably by the target population.

The primary ACT facility on campus is centrally located adjacent to the twenty-four hour access computer lab and is staffed 72 hours per week. Lab assistants are recruited from the disabled student population. These assistants are trained in basic computer use through the University Computer Lab training program and also receive adaptive technology instruction through a peer training program. Peer training provides the facility with student employees who are familiar with the adaptive equipment in the lab and who respond to service requests in an empathetic manner.

The primary ACT lab also serves as an assessment and training center. Persons with disabilities are encouraged to experiment with various adaptations. Exposure to a range of modifications, from varying price ranges, students are much better prepared to compete in the job market upon graduation. The experience with various pieces of equipment allows students to be more articulate in defining their needs in interviews with prospective employers.

The primary lab is open to University personnel for visitations to foster an understanding of what equipment is available and how its use can improve and enhance the teaching experience. Workshops are also conducted in the lab to assist incoming students in the use of appropriate adaptations and as preparation for required computer literacy course work.

Lab usage data has been compiled since 1991. Approximately 250 usages per semester were logged during the first year of existence. As new equipment was obtained and new adaptations were created the lab hours were extended and a full-time Coordinator position was created. Since that time the use of the primary facility has grown to approximately 1,500 usages per semester.

With approximately 450 students with disabilities registered for support services, an estimated 85% of the target population is currently served by the ACT program.

This increased demand for services necessitated the distribution of adaptive equipment to other University Computer Labs and Departmental facilities. Our program currently has adaptive resources in five additional UCL computer labs with equipment available upon request into other UCL facilities. Adaptive equipment is also currently available in three University library locations, the Office of Disabled Student Development, Students Services computer lab, two computer science departmental labs, two English departmental labs and the Business department.

Another crucial aspect of the ACT program is inservice training. Fundamental training for University personnel in facilities with distributed adaptive equipment is provided by the ACT Coordinator. Knowledgeable staff provide a resource for the users, as well as the Coordinator, and serve as contacts in the event of equipment malfunction.

Adaptive technology products are provided through a short-term loan program. This program has proven beneficial for students who need a product for a specific course and occasionally for those who may not have immediate funding available for their own equipment. The individual loaner program also serves as a vehicle for off-campus agencies to determine if a specific adaptation is appropriate for a client before a purchase is made. Adaptive equipment can also be loaned to academic departments exhibiting a temporary need. Short term distribution of equipment allows adaptations to be placed in an area of need only for the term of the need. Keeping the equipment in areas of need helps conserve campus resources and keeps a balance of adaptive inventory available.

The ACT program is part of the Academic Support Services group of University Computing Services. Consultation is provided for all campus units which includes recommendations for planning and purchasing. These recommendations are then sent to the University President's office, offices of the Provost and involved department chairs, Americans with Disabilities committee, and the Affirmative Action Office.

The ACT program also assists campus units to comply with requests for alternative media by individuals with disabilities. This includes braille, large print and electronic formats for pre-admissions information, syllabi, course handouts etc. The ACT Program is also involved in a full-scale effort to provide all University publications in electronic format for easy access via the mainframe computer systems. Course offerings and scheduling, campus phone directories and information, as well as student newspapers and employee publications are also included in this effort. The Coordinator also pursues information sharing and problem resolution by participation in various associations concerned with disability issues, i.e. National and State Associations of Higher Education and Disability, Equal Access to Software and Instruction, and the International Committee for Accessible Document Design, to stay abreast of current legal and ethical trends.

In order to anticipate and correct access limitations, the Coordinator meets regularly with the offices of Affirmative Action, Disabled Student Development, as well as the Americans with Disabilities Act committee, collegiate deans and departmental chairpersons, University Libraries, University College Learning Center, Media Services, and Facilities Planning personnel. Membership on the ACT, Campus Wide Information System, Indiana Higher Education

Television System, Indiana Association on Higher Education and Disability, Vocational Rehabilitation, and Office of Services for the Blind, as well as search and selection committees gives the Coordinator direct participation in establishing and implementing disability policy across the campus and the state.

The ACT coordinator enhances public relations and promotes the program through presentations at state, national, and international conferences, publishes articles about the program and adaptive technology, consultations with other education institutions and governmental agencies, guest lectures to undergraduate and graduate classes, as well as ACT program documentation.

Ball State University is committed to compliance with the Rehabilitation Act of 1973, Section 504, and the Americans with Disabilities Act of 1990. Based on the National Institute of Disability (NID) publication, "The Impact of Exemplary Technology-Support Programs on Students with Disabilities," Ball State developed a checklist of services to be provided. All applicable categories of service are being addressed or implemented by the ACT program. Additional services, not specified by the NID report, are also being provided to individuals with disabilities. The "Checklist for Implementing Accessibility in Computer Laboratories at Colleges and Universities," published by the Trace Research & Development Center, is also followed by the ACT Program Coordinator. Nearly all of the recommendations listed have been implemented and the remaining applicable items have been addressed in the new ACT budget. With this leadership and focus, the program assures enhanced electronic accessibility for students with visual, mobility, hearing and learning disabilities at Ball State University.

NOTES

[1] Campus Update. Vol. 12, Nbr. 24,p.1., Feb. 24, 1992
[2] Section 504, Rehabilitation Act of 1973, Regulation Section 104.3 (j)(1)
[3] Ibid, Section 104.3 (K)(3)
[4] Ibid, Section 104.44 (D)
[5] Americans with Disability Act, Title II, Section 35.151A
[6] EASI Computer Access Facts, EDUCOM, Washington D.C.
[7] From Ball State University Mission Statement
[8] From University Computing Services Mission Statement

Back to the Future -- A Management Perspective on Distributed Support

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Abstract

In spring of 1995, Information Technology at Rice University began to implement a distributed model for computing support. The approach decentralized customer support into the academic divisions.

The model involves matrixed teams from across Information Technology, the Library, and existing departmental staff. The academic division provides office space and a faculty advisor for the team. The team provides one-on-one or small group training, consulting, reference service, and systems administration. IT facilitates a campus-wide view of technology and architecture, maintains a central view of budget and staff, is accountable for service level commitments, provides core services such as mail and news, and provides technical support for team members.

This paper will address management aspects of distributed support. We will focus on the implementation process, changes that were required in transitioning from a strong centralized organization to a distributed/central model, the opportunities and challenges that are being faced in the implementation, and what we have learned so far.

Retrospective

Prior to 1995, Rice University's Information Technology division used a traditional centralized model to support the computing needs of our 6000 users. Over the last two years, we had distributed one consultant into each academic division, but our focus was still on central services. These services were available to the entire University community, but several departments chose to fund their own computer support personnel from research grants.

In the spring of 1994, many systems support personnel across all departments were folded into the IT organization. At the same time, top management in Information Technology demanded a dramatic change in customer satisfaction. These two factors led to the distributed teams support model.

Distributed Teams Model

Under the distributed teams model of support, Information Technology staff and reference librarians are assigned to matrixed support teams and dedicated to specific academic divisions. Each divisional dean appoints a faculty advisor to set priorities for resource allocation within that division. An Information Technology director is assigned to each team to resolve escalated issues and facilitate communication.

Process

To implement the distributed teams model, the IT directors developed a concept document that was reviewed with the Vice President and the Executive Director. This document included a description of the distributed teams model, problem resolution goals, a description of base level services, and a standard suite of supported software. The draft went through many iterations and was then shared with the deans, their designated divisional advisors, and key faculty.

- Division Perspective

Under the new model, the division provides space for the team and a faculty advisor. The faculty know their support staff by name and face and have easy access to team members. The team provides continuity of support for projects across the division.

- Team Perspective

The team knows who their customers are and can provide better day-to-day and long-term project support. By working closely with their customers, the teams can observe how the faculty use computers in their teaching and research and can show them new ways to enhance their productivity. Team members pool their expertise to resolve difficult problems and have designated staff in the central second level support group to help them resolve technical issues. A clear path for prioritization and escalation is provided through the designated division advisor and IT management.

- IT Perspective

IT facilitates a campus-wide view of technology and architecture, maintains a central view of budget and staff, is accountable for service level commitments, provides central services such as mail and news, and provides second level technical support for team members.

Management Expectations

The management team expected the move to divisional teams to create a quantum leap in user support, so we developed several goals and expectations for results:

- Customer satisfaction must improve 100%.

We made the commitment to improve customer satisfaction by 100% during the first year of distributed support. The results of a survey given before and after implementation will provide the data needed to see if we have met that goal.

- Communication is critical and must be maintained.

Communication is critical at all levels, within the team, between each team and the rest of the IT staff, and most of all between the directors.

- Users set their own priorities.

Each division is expected to set their own priorities for computer support through the divisional advisor and the teams.

Our Approach

Our vision for divisional teams was based on several approaches -- deployment, well defined staff roles, and problem resolution.

- Deployment and collocation

The directors of each department within Information Technology reviewed the skills of the staff members in their group to determine how to fill the team roles. Considerations were made for interpersonal skills, maturity and judgment, ability to work with minimal supervision, and leadership capabilities. Each director then discussed the distributed team concept and specific team assignments with their staff. Reaction ranged from enthusiasm and skepticism to belief that the project could not work. When several staff chose to leave the university rather than participate, management used the opportunity to hire professionals whose skills rounded out the teams.

The divisional deans were asked to provide space for the teams. Engineering and Natural Sciences provided space quickly. Architecture and Music used a previously allocated space. We are working with Social Sciences to provide space before the spring. We do not expect space to be allocated within Humanities for several years until some of their space constraints are addressed.

- Staff Roles

The team leader is responsible for determining how the teams will dispatch problems, escalating issues to management, and providing feedback on the performance of team members. Consultants provide one-on-one or small group training and front-line user support. Reference librarians are responsible for providing reference service and training, and system administrators provide first and second level support. The central group maintains central resources like mail and news, provides technical expertise to staff members out in the field, and manages campus-wide projects such as operating system transitions, volume purchases, and site-license management. Second level staff are designated to support each team and may be directly contacted.

- Problem Ownership

Under guidelines set by each divisional team for problem dispatch and assignment, staff are responsible for following a problem through to resolution. Whether they solve the problem themselves or call in second level resources, they are still required to monitor the status of the problem and assure a satisfactory resolution.

Operations

Implementation of distributed support resulted in some major changes, opportunities, and challenges for the management team.

Changes

Given the redeployment of staff, we had to rethink our business in several areas. We needed to create a unified service philosophy, distribute the HelpDesk, transform our training program, and create new communications paths.

- We need a unified service philosophy.

While we were planning the support model, we felt that it was important to create a service philosophy in the agreement with our users. After analyzing our consulting data, we determined that 70% of the demand was solved on the front-line, 20% with a call to second line support, and 10% required investigation. We crafted these general goals and more specific task-related goals into a service agreement (Appendix A). With this agreement, we can better manage user expectations, and the staff is held accountable for meeting the goals.

- We now have many HelpDesks.

Under the new model, we distributed the HelpDesk. Consultants who formerly worked on the HelpDesk were deployed on the divisional teams and took that function with them. The central HelpDesk is run by students for students and is managed by a staff consultant.

We still support a central helpline, but users now get a menu that enables them to select their divisional team or the student HelpDesk. Faculty and staff are referred to their support teams, and students are referred to the central support desk.

- Our training coordinator does a lot of walking.

Given that we deployed two thirds of the training staff into the teams, we needed some creative approaches to handle the training load. First, we relied on the teams to provide "just in time" one-on-one training for the faculty and staff. We also met with the teams to set up a monthly schedule for central training in the divisions, and were proactive in anticipating needs. For example, we knew that wiring the residential colleges would create a demand for training, so our student trainers were ready to teach classes when the wiring was completed. [1]

- How can I get a hold of you?

When staff are distributed over the campus, the need for communication intensifies. While good relationships among management and the staff enabled the change to occur in a less dramatic way, we needed to rethink our information flow. When everyone is located in the same building, you can go down the hall to find a staff member. When that person is located across campus and is out working at a customer site, the problem is more challenging.

To help us in communicating, we used a multifaceted approach. Our staff used traditional electronic communications like electronic mail, listserv lists, and the problem tracking system. To facilitate one-on-one contact, we issued beepers to support staff and management and created an e-mail paging service. We also had to increase the number of scheduled meetings; informal meetings that happened "at the refrigerator" now must be scheduled.

Opportunities

Dramatic changes often bring new opportunities. These opportunities include partnering with your users, reaching your faculty, and using technology to work smarter. The key is to recognize the opportunities and take advantage of them when they occur.

- How can we partner with our users?

We find that our divisional teams are now allies for a common cause with their divisions. As partners, we work together with the faculty to justify additional staff resources and make joint proposals for lab space. Our staff also influence computing purchase decisions and direct their clients to supported platforms.

- Are you reaching your faculty?

By living in the same space with the customers (i.e., "breathing the same air"), our staff start to learn about their research interests and their needs. As a manager, you need to take every opportunity to ask faculty how they are being served. Whether you are walking across campus, waiting in line at the faculty club, or visiting a faculty office, you should take advantage of the moment to inquire about the job your staff are doing. Are they getting good responses? Is the information timely? What have we done for you recently? If the response is, "Joe who?", you know you have problem to investigate.

- How can we use technology to work smarter?

In the Information Technology business, we have a mandate to integrate technology into education, research, and administration. As we distribute our staff, however, we need to use this technology to help us work smarter:

1. Our problem tracking system captures twice the information that it used to - data from the central HelpDesk and data from the divisional teams. What can this data tell us? What are the trends in our divisions?

2. As we wired the dorm rooms for cable TV and ethernet this summer, we realized that we could use the cable network as another way to train students. This year, we will pilot internally developed and commercial training videos. Will this program reduce our need to offer central classes for the students?

3. An interest in telecommuting resulted in an ISDN pilot project. The project was successful and is being expanded to accommodate additional users. How will management need to structure jobs and communication for this program to succeed? How will the telecommuting model affect the distributed teams?

4. We are installing video conferencing capabilities in a new classroom in the library and recently acquired several Mac-based video conferencing packages to test among the staff. How will video conferencing enhance our team interactions? How will it help facilitate distance learning opportunities? Will we start putting our ISDN addresses on our business cards?

Challenges

Migration to a new support model presented several challenges to the management team in the areas of staffing, supervision, client differentiation, and consensus building.

- We really will do more with less.

Allocating most of the staff to divisional teams means that fewer staff are available to deal with crises or new projects. This translates into better planning among the teams and management. For example, our HelpDesk is staffed primarily by students to support students. During mid-terms and finals, however, students focus on their studies and are not available to work consulting shifts. Students still need consulting help, so we have to be creative in finding a solution. In this case, we called upon staff in the divisions to work the desk. The staff were glad to help and enjoyed renewing their skills and working as part of the central team.

- Lack of interpersonal skills is exposed.

User Services staff are hired based on a combination of interpersonal and technical skills. Until recently, other parts of the IT organization based their hiring decisions primarily on technical skills. When some of these backroom staff were assigned to teams, they had to rethink their interaction styles. In the short term, several staff are in an uncomfortable position. Over the longer term, we are hiring staff who can communicate with our customers, so this problem should go away.

- How do you monitor what you cannot see?

Several divisions were concerned about how deployed staff would be supervised. Given that staff work all over the campus, how can you monitor their performance? Our solution to this challenge was to upgrade our public domain mainframe problem tracking system to a commercial grade Unix problem tracking system in August. We developed log sheets on HTML forms that allow staff to track their work and report problems that need additional resources for solution. We also developed summary reports that are posted to the entire IT organization, the team faculty advisors, and RiceInfo. The reports analyze incidents by division, problem areas, and team.

The key to this approach is that the teams want to get credit for the work they do. It helps the faculty understand how they are spending their time, and the staff know that we need to document the load to justify additional resources.

- Some clients were used to premium service.

Under the previous support model, some clients paid for contract support and received a premium level of service. The rest of the campus participated in a first-come, first-served model. With the new model, all clients receive the same level of support.

- It is difficult to reach consensus on software standards.

When we first conceived the support model, we wanted to put some boundaries on the number of software packages and platforms that the teams would have to support. We realized that it was unrealistic to expect every staff member to be fluent in every package, and we also recognized that each division had some discipline specific software needs. To overcome this challenge, we worked with the staff to develop a supported software list. The list also gave us a way to focus training efforts for staff and students. While the concept looked great on paper, the reality is that the staff will support whatever their divisional faculty want them to.

- And more are on their way.

We have been using matrixed teams for over 5 years. Our current support model adds one more level to the matrix. We will be evaluating how to continue growing our team model and will look at use of self-directed teams and ISO9000. We will also look at our reward model -- team-based support needs a compensation and evaluation model that rewards successful team participation. In addition, the departments want the funding for their teams transferred into their budgets. How would that change the balance?

Progress Report

The model is working. IT management and the teams regularly receive positive feedback from the deans and the faculty. Irate faculty calls to the Vice President's office have been dramatically reduced.

The implementation of the distributed teams support model is a work in progress. We will give an update when this paper is presented.

References

[1] Martin, Andrea and Diane Butler. "Taking the Show on the Road: Training in a Distributed Support Environment." Proceedings of the ACM SIGUCCS User Services Conference XXIII, October 1995, pp. 193-195.

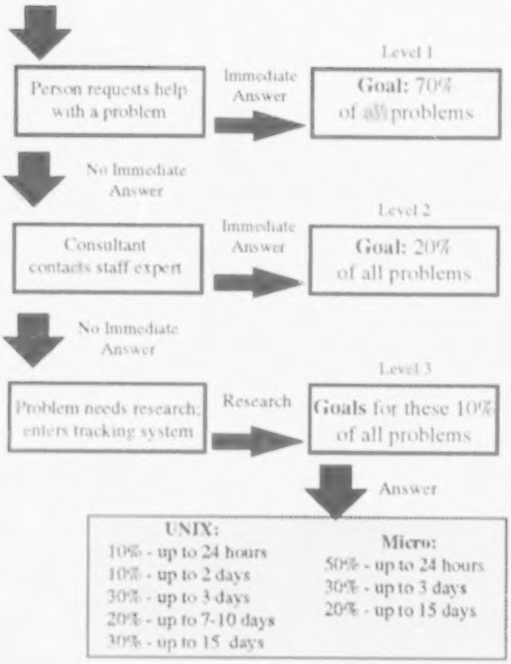
Problem Resolution Goals

Our objective is to answer all questions and resolve all problems immediately. Realistically, we recognize that this is not possible in every instance- but our goal is to solve 70% of all incoming problems at initial contact. See the sidebar for examples of questions that can be answered quickly.

If a problem cannot be solved by consultants on duty, they will contact a staff expert for assistance. Our goal is to solve 20% of the incoming problems at this point, Level 2.

If an expert cannot be reached or a problem requires the assistance of technical staff, the problem will be entered into our problem tracking system. For a detailed breakdown of turnaround times for specific types of Level 3 problems, look on the facing page. (All time frames are given in working business days.) If a microcomputer problem cannot be solved over the phone, an appointment will be scheduled for a consultant to visit your office.

Once a problem is entered into the problem tracking system, one consultant "owns" the problem and will ensure that the necessary staff members are contacted to help solve the problem.


Level 1
Person requests help with a problem
Immediate Answer
Goal: 70% of all problems
No Immediate Answer
Level 2
Consultant contacts staff expert
Immediate Answer
Goal: 20% of all problems
No Immediate Answer
Level 3
Problem needs research; enters tracking system
Research
Goals for these 10% of all problems
Answer
UNIX:
10% - up to 24 hours
10% - up to 2 days
30% - up to 3 days
20% - up to 7-10 days
30% - up to 15 days
Micro:
50% - up to 24 hours
30% - up to 3 days
20% - up to 15 days

Quick Solutions

- Regenerate a new password for a forgotten one
- Explain how to get an account
- Assist with logging on troubles
- Distribute software, such as communications (MacSlip, PCSlip) or virus protection programs (Disinfectant, F-Prot)
- Answer questions on supported programs, such as electronic mail (Elm, Eudora) or a word processor/editor (Microsoft Word, vi, Gnu Emacs)
- Explain how to access Rice computer systems from off-campus
- Point to information on a specific computing topic, such as documents or to RiceInfo
- Recover a damaged file on a floppy disk
- Respond to basic questions on the commands of the UNIX, Macintosh, and IBM operating systems, such as how to print, how to FTP a file, backup and recovery procedures
- Explain how to access the Internet
- Much more!

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COLLABORATING FOR THE MORE EFFECTIVE INTEGRATION AND USE OF TECHNOLOGY

Track IV: Rethinking User Services
29 November 1995, Wednesday, 2:45 pm

Kenneth E. Pflueger, CIO
Director of Information Services
California Lutheran University
Thousand Oaks, California

Abstract

Like many other institutions of higher education California Lutheran University made a substantial investment in a very sophisticated technological infrastructure, but questions remained as to whether technology would be utilized widely and fully. In particular there was great concern about whether it would be utilized to enhance the teaching/learning environment at the University by a substantial number of the faculty. A task force representative of faculty, human resources and ISS was charged with evaluating past efforts and proposing strategies for the future. The old strategy had consisted primarily of short courses on particular software or demonstrations of possibilities. The evaluation results indicated that while the old strategy had a place, continuing the same type of activities was not going to further our goals. A new strategy was proposed and implemented which combines certain types of training with new employee training as well as with programs for existing employees. The program has two major parts to it, both focusing on peer mentoring as the chief approach. The first tier deals with competencies in a set of predefined technological skills while the second tier focuses on competencies and skills in specific software or applications. The results of the evaluation after the first year of the new program indicate resounding success.

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Background

California Lutheran University (CLU) is a small, comprehensive university with about 2700 students and 110 full-time faculty, 29 majors and 4 Masters' degree programs. During the months of July/August 1994 the University underwent a major transformation with the installation of a new ATM ready digital phone system, a fiber optic backbone with all staff/administrative/faculty offices, classrooms and the residence halls (one port per pillow) connected to the campus network with level 5 copper. The University went virtually overnight from a couple of pockets of technology with two stand alone local area Novell networks, to having more technology than most people knew what to do with, and all interconnected.

Introduction

This major commitment of resources by the University thrust technology into the forefront of the University's strategic planning process which includes as a major goal the integration of the use of technology into the operational and educational environments of the University. I believe that the prioritizing of this goal helped foster an environment that was open to collaborative efforts. The University's commitment to technology and its desire to get the most out of its investment were further inducements to collaboration as the University continued to define and refine its vision for a sophisticated, user centered technology infused into all aspects of university life.

Four sub-goals have been delineated under this main goal:

Instructional Goals

Utilize technology to enhance the quality of student/faculty interactions.

Integrate technology significantly into the teaching/learning environment in order to equip students and faculty with knowledge/skills they will need to live and work in the 21st century.

Administrative Goals

Utilize technology to increase the efficiency and effectiveness of work processes.

Provide students with a higher level of service and more timely information.

Implementation of Goals

These goals presented a tremendous challenge to the Office of Information Systems and Services (ISS) which was charged with providing leadership in accomplishing them. These goals, however, have also ushered in a period of great professional and personal satisfaction and collegiality among ISS staff and across the entire campus. In the tamer pre-network days (pre-September, 1994) a fairly traditional training program was conducted with academic computing, the library, administrative computing and telecommunications each providing their own workshops. While the workshop offerings were aimed at raising the skill level they often ended up being sessions aimed at trying to convert people to use technology. In retrospect, the training programs were, more often than not, too general and did not address the specific needs of individuals and departments at CLU.

Evaluation of Former Training Program

Post-network and with the integration of these separate areas (academic computing, the library, administrative computing and telecommunications as well as media services) into the Office of Information Systems and Services, it became clear that the former training efforts of exposing people to as much as possible and hoping that they would use something was not going to be adequate to achieve the University's goal. This was confirmed by a survey which was conducted of users to ascertain their perspective and provide information for the development of a new training program. The survey results are captured by the following comments:

- The courses are too advanced for me and I felt lost.
- Too much time was spent on basic things that I already knew.

- It was interesting, but I cannot see how I would use it.
- It worked in the lab, but I could not get it to work on the computer on my desk.
- Too much material was covered in too short a time.
- Not enough time for hands-on.
- I really do not have time to do anything with what I learned.
- I don't go because I am so computer illiterate that I could not learn anything in the class setting.

None of the comments really surprised members of the ISS staff. The last comment reminded us that as a small campus people were used to more personalized attention: we agreed that we needed a new approach and that the new integrated organizational structure for ISS would serve as the means to define that approach and to actualize it. As an integrated department ISS was best positioned to provide leadership for a collaborative training effort since its responsibilities cut across the University: computer basics, phone/voice mail, applications software, HTML, and bibliographic instruction.

ISS put together a task force made up of faculty, staff and administrators to collaborate in planning a comprehensive and yet user specific training strategy. Members were chosen because they could network with other related committees on campus. For example, one of the members is active in the University's Teaching and Learning Center for Faculty Development, another is a member of the University's General Education Committee, another is on the steering committee for the University's middle management organization, etc. The membership of the Task Force was as follows:

CIO
Director of User Services (ISS)
Dean of the College of Arts and Sciences (Liaison with the Academic Council)
Faculty (TLC)
Faculty (General Ed. Committee)
Faculty (Grants Office half-time)
2 administrative staff (middle manager)

The Task Force met in several brain storming sessions to develop a new approach to training that would address the concerns raised in the survey. Several recommendations came out of this process:

- The Task Force should function as the coordinating and evaluating body.

- Since ISS cuts across the institution in terms of its functions and the constituencies it serves, it should be the primary vehicle for delivering and/or managing the delivery of training for faculty and staff, and should team up with faculty for delivery to students.

- The Task Force should identify and recommend a list of basic computer competencies which would be required respectively of all faculty, staff and students.

- HR should work with the various managers within the University to review position descriptions and update those descriptions to include the requisite technical skills using the "basic competencies list as a starting point.

- Managers would use the revised position descriptions to evaluate an employees abilities and identify skills that were either weak or lacking and based on that assessment develop a plan to address those deficiencies for each staff person.

- A special handout with a list of courses from the course offerings would be developed for all new employees. New students would be expected to take an introductory workshop to the campus network during the first weeks of the semester.

- The resultant training program should be of a more personal nature and reflect the particular needs of CLU.

Basic Competencies

The Task Force recommended the following as basic competencies for faculty and staff. Greater priority was given to getting faculty up to speed in order to expedite the impact on the classroom. The Task Force set as a goal the training of 90% of the faculty in the basic competencies by the fall of 1996. These basic competencies were defined as follows:

- E-mail - communicate electronically on and off campus. Make new messages, reply to messages, forward messages, file messages, make address books, attach files to messages.

- Operating Systems - use the basic functions of file management and information sharing between applications. Back-up data, copy files, develop organized file storage system using folders/directories, ability to move information between applications using copy/cut and paste.

- Internet - know when and how to use the various tools for research and teaching. Use Netscape to access the University's Home Page, search the WWW and Gopher (use search tools such as WebCrawler and Lycos), become familiar with WWW directories and browsing strategies (tools such as Yahoo, Whole Internet Guide, etc.) to identify electronic sources of information for research and teaching or for use in a particular administrative office.

The liaison from the Task Force with the General Education Committee of the faculty was charged with taking the basic competencies list to the General Education Committee which has been charged by the Academic Vice-President with developing a similar list for students as part of a revision to the University's core curriculum. (As well as address more advanced skill levels.) The Core Revision Proposal is to go before the faculty in the spring semester 1996 for discussion and a vote.

Proposed Training Program for Faculty

The proposed training program for faculty has two parts:

1. A program to address teaching the basic competencies to faculty.

2. A program to address developing advanced skills and applications beyond the basics.

The group looked at the results of the survey evaluating the former program and the recommendation for a personalized approach and decided to try utilizing a mentor model as the programmatic approach for dealing with basic competencies. The model was tested on a select group of the faculty in the spring of 1995. Faculty who had shown themselves to be relatively technically sophisticated were polled and asked if they would be interested in mentoring two of their colleagues in a set of pre-defined basic technical competencies.

The time commitment and suggested format of the mentoring was as follows:

> Minimally, an initial two hour meeting with two additional one hour meetings as follow-up about two weeks after the initial session. During the time between sessions, the mentor should make a concerted effort to keep in touch with his/her faculty mentorees, sending them e-mail regularly, responding to any questions, etc. During the sessions, but in particular, in the two follow-up 1 hour sessions, in addition to reviewing the basic competencies and answering questions, mentors spend some time talking with the faculty member about the ways he/she use technology and probe the potential ways the faculty member might incorporate the use of technology into his/her courses.

We ended up with 12 faculty who said they would be interested in serving as a mentor. To select the test group of mentorees the Task Force reviewed a list of full-time faculty and set the following criteria for asking someone to participate:

1. Prior expression of interest.
2. Has attended a workshop before, but expressed frustration, etc. over use of technology.
3. Knowledge of someone in the group of an interested potential user, but someone who was not proficient.

Twenty-six faculty were identified as potential mentorees. Each faculty member was personally contacted by the Director of ISS and asked if they would be interested in participating in the test of this new delivery system. Of the 26, 23 said yes and two more called to ask if they could be part of the initial group, so we started the initial program with 12 mentors (4 women and 8 men) and 25 mentorees (11 women and 14 men).

An initial survey was conducted of mentorees in the summer of 1995 to evaluate their initial response to the program and to provide us feedback on whether or not we should move to implement the program on a large scale in the fall of 1996. A more formal evaluation was also developed by two faculty which was designed to do more in-depth evaluation of both the mentors and the mentorees. This evaluation was conducted by two faculty members and one ISS staff member. Their findings are awaiting publication. The initial survey conducted by ISS in summer, 1995 had very positive results:

- A small number of faculty indicated that they had not had the time to follow through and meet with their mentor.
- One mentor admitted not having followed through with his assigned faculty.
- The response was resoundingly positive. All participants commented on their appreciation for the personalized one-on-one interaction which allowed them to ask questions specific to their own needs.
- Mentorees also indicated that having the sessions in their own office on their own computer was very beneficial.
- Several mentorees stated that they appreciated the experience because now they had a colleague they could call on for additional advice and discussion about technology.
- Three mentors have even gone one step further to develop joint efforts to integrate technology into their teaching with their mentorees.

Did the faculty actually learn what we hoped they would? A difficult question since we were not about to put ourselves in the position of giving a test to faculty. We decided rather to evaluate our success based on the performance of these faculty in subsequent workshops requiring use of the basic competencies. The proof of their learning was evident as they participated in the second half of our training program which consists of a series of workshops focused on specific applications of technology to teaching. Of the original 25 mentorees, 13 took part in the summer, 1995 workshops. Workshop leaders were asked to pay particular attention to the performance of these faculty so that we could make some judgment regarding the success of the mentor program. The performance of the mentorees who took one or more workshops in late summer/early fall, indicated that our mentoring program was a great success. These faculty were able to move through the workshops with few problems and all are now using one or more new found techniques this semester.

Presently, twenty-five percent of the full-time faculty are being targeted for participation in the mentoring program each semester so that by the end of the 1995/96 academic year, 95% of all full-time faculty will have participated in the mentoring program.

Training for Integrating Technology into the Classroom

The possession of the Basic Competencies by faculty are considered the essential foundation in order to accomplish the goals of the University related to technology and instruction, and are pre-requisites for taking the advanced workshops offered to faculty. To address the use of technology to enhance student/faculty interaction and to integrate technology into the teaching/learning environment, a series of workshops have been developed for faculty which focus specifically on the accomplishment of these goals. Our target goal is to have 95% of the faculty having successfully completed at least two of these workshops by the end of the intersession in January, 1997, by the fall of 1996 to have 60% of the faculty utilizing technology in some form in their classes, and increase that amount to 90% by the fall of 1997.

The faculty workshops teach the "how to" of a particular piece of software or tool, but also incorporate strategies for implementing their use within the instructional programs of the University. The workshops included:

Enhancing the Presentation of Course Materials

Participants should come with an initial idea for incorporating presentations (PowerPoint) into the teaching methodology of at lest one specific course.

The workshop will cover PowerPoint's basic commands and tools. Discussions of utilizing visual images to organize and present ideas will serve as a stimulus for each participant to work on the design of one or more instructional units for a particular course. Participants will explore models on the use of presentations software for students as a tool or posing a question, and exploring the issues and organizing the results into a presentation.

Participants will:

a. implement their initial idea for using presentations by developing a prototype for use in a course, and
b. master basic PowerPoint commands and tools.

Dangling your Coursewares on the World Wide Web

Participants will learn how to develop their own home pages for a particular course or part of a course. Discussions will include home pages as: tools for helping students to frame a research question and present the results; pathfinders to navigate the myriad of resources on the Internet to explore a research question; an alternative to research papers or publishing original work; and lecture and review tools.

Participants will:

a. identify one course for using home pages
b. develop a prototype home page for a course, and
c. master basic HTML commands

Enhancing Student Interaction through Electronic Dialog

A listprocessor has many potential educational uses for enhancing discussion and interaction in and between classes and different groups. It can even be a means for holding students accountable for course related discussions outside of the classroom as well as preparation for in-class activities.

This workshop will be comprised of two parts. The first half will cover the basic commands required to manage a listprocessor discussion list. The second part will consist of a discussion among the participants of the potential uses of listproc within their courses and will serve as the catalyst for each participant working on incorporating the use of a listproc discussion group in one or more courses to engage students actively in the exploration and organization of information as it relates to the content and/or assignments of that course.

Participants will:

a. master the basic listproc commands;
b. identify a course in which to use a discussion group, and
c. incorporate the use of a discussion group into the course syllabus.

Results of New Program

A survey of department chairs, conducted in early October, 1995, indicated that there were 31 faculty who had already integrated the use of technology into one or more of their courses for the fall, 1995 semester. Examples of what these faculty are doing include:

> use of PowerPoint for class presentations, use of Intel Proshare for tutorials between main campus and branch centers, use of listproc for on-line discussion groups, use of the home page to present an interactive course syllabus, and Internet resources cited on course bibliographies as well as requiring their use in literature reviews by students.

Student response to the results of the use of technology will be integrated into the standard course evaluations. The results of a random survey of students in late October, 1995 are best captured by the following comment provided by a student on that survey:

> "How exciting! Thanks for bringing Cyberspace into the classroom and modeling for us how we can make use of it. Your use of CLUnet made this class come alive."

Administrative Staff Training Program

Basic Skills

Because of the wide degree of skill level amongst staff relative to technology, much wider than the faculty, and because of the success of the faculty mentoring program, it was decided to utilize this approach with staff as well. However, we did not have enough staff to implement a mentor program across all departments. Hence, it was decided to take a slightly different approach from the faculty and cultivate one or more mentor/experts in each office. We are providing an intensive training for potential mentors during this fall semester. Our goal is to implement the mentoring program fully for staff during our intercession in January, 1996. Rather than ask for volunteers, each manager was asked to identify one or more staff (depending on the size of his/her department) who would serve as the mentor and become the resident expert for that office. As further inducement, staff who serve as mentors will be offered the ability to earn one additional floating holiday. In three of the larger offices we did not have enough individuals come forward so I went to the managers of those areas to discuss the situation. In two of the cases additional individuals were identified. In the third area, the manager felt that the one individual who had volunteered would be adequate. The purpose of the mentoring program will be to focus on the same three areas of basic competency as with the faculty. Netscape is included for staff because the University is moving in the direction of using its WWW Home Page as the gateway to information on and off-campus. Upon completion of the installation of the University's new administrative system, Netscape will be utilized by staff, faculty and students to query the administrative information system for data. Since implementation of this interface is about a year off, a fourth item was added to the staff list of competencies:

> knowledge of constructing basic queries in the University's new administrative information system.

Advanced Skills

The second tier of training for staff focuses on productivity tools that are available on the network. Inspired by success with faculty workshops which focused not only on the "how to," but also included the application of the "how to" to particular situations, the courses for staff on productivity tools employ examples from the CLU work place and invite attendees to think about how to use these tools to work smarter.

Under exploration via discussions currently at the President's Cabinet, is how ISS can team up with the various departments to focus on the impact of technology on processes and the need for process re-engineering. The conversations are centered on how mere utilization of technology may require changes in these processes as well as discussing how changes might be necessary to get the full benefit from technology. These conversations are particularly critical in light of the University's implementation of an entirely new administrative information system in all offices.

The ultimate success of our staff training efforts remains to be seen, but I am convinced that we can repeat our successes with the faculty in the staff training program because as collaboration brought success in our faculty efforts, similar collaboration will lead to success amongst the staff. If these efforts were only those of ISS or some other department I would be less hopeful.

Conclusion

Collaboration and commitment have worked because they emanated from the top. The new training efforts and successes are due in part to the fact that such plans were discussed at the level of the President's cabinet which has helped insure sustained enthusiasm and support. Indeed the ISS team is not only surfing the net, but riding the crest of a most powerful wave, collaborative teaching and learning for more effective integration and use of technology. It continues to be an exhilarating experience, especially as our training programs continue to evolve and to weave their exponential effects.

The Risks of Success: Sustaining and Supporting Mainstream Use of Instructional Technology

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ABSTRACT

Much recent discussion has focused on the failure of instructional technology to move beyond the more technically inclined "early adopters" among the faculty and to engage the active involvement of mainstream teaching faculty. The support structures in place today seem more attuned to the early adopter population--both in types of support offered and the extent of support available--than to the interests and needs of the mainstream.

This paper will focus on three principal topics: strategies for engaging mainstream faculty in the effective use of information technology for instruction, the risks that success in this endeavor brings with it, and institutional strategies for supporting and sustaining mainstream involvement once it has been attained. Discussion will cover such topics as the real and perceived value of instructional technology, costs, infrastructure requirements, and scalability, along with examples drawn from experience at Stanford, UNC Chapel Hill, and other institutions.

Paper Not Available

The Leveraged Support Model-
How to Support Work in a Distributed Computing Environment

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ABSTRACT

Computing support used to be so easy in the mainframe-only days. But with the arrival of microcomputers, desktop computing, client/server applications, and the Internet, support for users can no longer be effectively done by the computing center alone. As a result, a need for local support has emerged.

Indiana University has been working for over five years to establish, foster, educate, and coordinate a diverse and talented local support provider environment. It has established a partnership with the community of departmentally-based support staff who can help each other, and who rely on the central computing organization for education, certification, and support information and tools. It is now working on ways to empower the users themselves, to support their own use of computing technology by integrating problem management systems and knowledge bases via an easy- to-use Web client front-end.

Paper Not Available

Information Technology Planning: Letting the Users Take Over
A Federated Framework for Information Technology Planning[1]

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Abstract

The management of information resources at the University of North Texas campus is a shared responsibility between the schools and colleges and centralized service agencies, such as the Computer Center, the Library, and the Instructional Technology Center. Their roles, responsibilities, and services are coordinated through a representative university council: The Information Resources Council (IRC). The IRC is responsible for recommendations to the University's Vice Presidents and for participation in the university planning processes. The key to the success of this model is the cooperation and teamwork of all participants. Fundamental to the Council's organization is the role of the information technology user is the planning process. The Council is divided into program groups which have larger user components, and are often led by information technology users rather than information technology professionals. The UNT experience highlights how a user centered federated IT model can overcome traditional organizational barriers and boundaries, and be highly responsive to user needs.

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[1] This work was undertaken while the authors were at the University of North Texas.

Introduction

Colleges and universities are undergoing fundamental changes which will have direct impact on information technology services and structures. The demographics of higher education is changing with an increasing proportion of non-traditional learners entering university study. Expectations for services are rising, and students as well as faculty expect information and instruction on demand--any time and any place in a seamless information environment. The power of information, communication, and instructional technology is exploding and the focus of these technologies is converging.

Although this experience is common across universities, there are many models for service delivery to users. Because of various institutional histories and traditions, information technology organizations range from highly centralized to highly decentralized, and provide for user participation to varying degrees--active participation in management to cursory consultations. Each model has varying degrees of costs and effectiveness associated with it. Ideally each model should addresses the specific needs and environments of a local institutions in the most effective manner.

The management of information resources at the University of North Texas campus has evolved into a shared responsibility between the schools and colleges and centralized service agencies such as the computer center, library, and instructional technology center. Their roles, responsibilities, and services are coordinated through a representative university council: the Information Resources Council (IRC). The roles and responsibilities of the IRC have developed around two major features of the university: the concentration of information technology and the diversity of organizational structure.

The University of North Texas is a doctoral degree granting institution of 26,000 students located in the Dallas/Fort Worth area. Because of the need to keep staffing low at a state university, the university strategy was to trade people power for information technology power. Additionally, there was a strong commitment to the use and development of information technology in the research and teaching environment. According to some accounts, the University of North Texas had the highest per capita expenditure for information technology of any state assisted university in Texas. Needless to say, technology not only plays a strong role in the university but also represents a substantial investment. Unfortunately, while there was a clear vision to invest in technology, there was no consensus on how to managed this very sizable university investment.

As was common in many other universities, there was a dispersion of information technology organizations throughout the campus. Responsibility for information technology included centralized agencies such as the Computing Center, the University Library, the Center for Instructional Services, the Office of Telecommunications, and the specific computing and instructional technology organizations located in the university's eight schools and colleges. In addition, the university had a separate information technology structure at the Health Science Center in Fort Worth. The various information technology providers reported to different vice presidents within the university. The Computing Center reported to the Vice President for Fiscal Affairs, while the Office of Telecommunications reported to the Vice President for Administrative Affairs. The remainder of technology providers reported to the Vice President for Academic Affairs and Provost.

History and development of the IRC and its user-centered program groups

The IRC developed out of a transformation of a computer advisory committee whose scope and mission was much more narrowly focused. Although this committee had a long history of providing user participation and guidance to the central computing organization, it often narrowly focused on issues of central computing versus decentralized computing and academic computing versus administrative computing–issues that by their nature created conflict and controversy. As the difference between these issues became more controversial and pronounced, it became clear that something needed to be done to refocus on the "bigger picture."

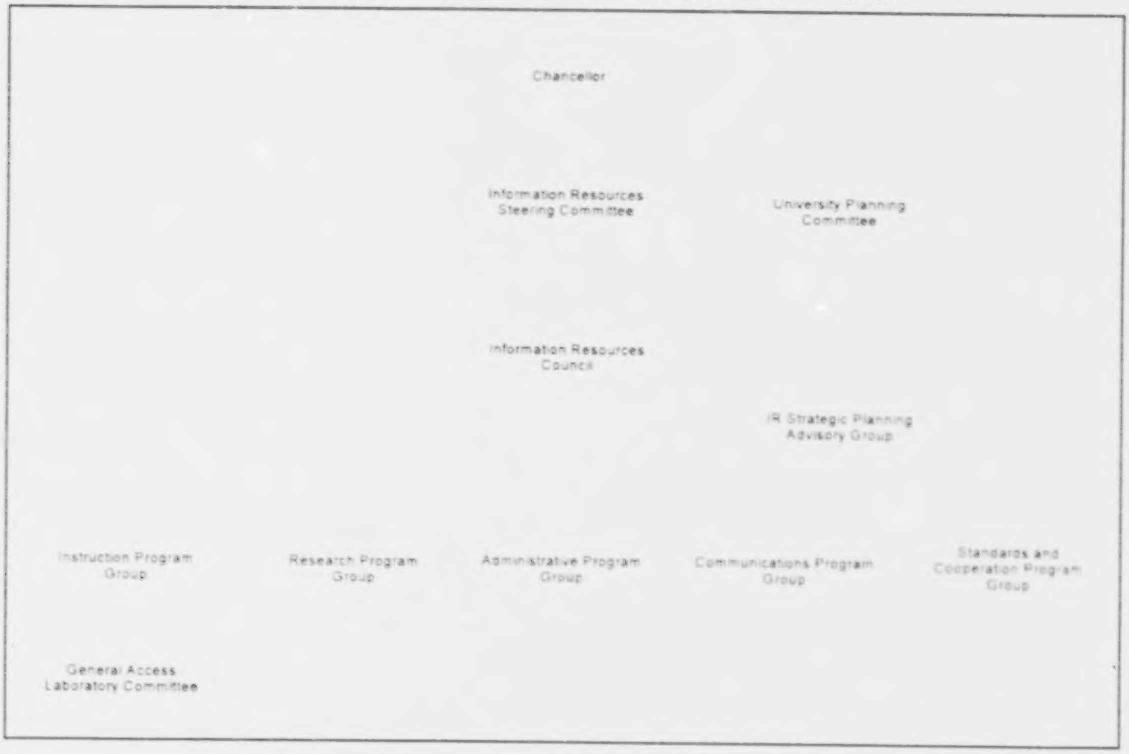
To initiate this redirection, the computer advisory committee was reconstituted as the Information Resources Council and its role expanded to address information resource and technology needs across agencies and media throughout the campus. The intent was to create an information technology organization that would:

1. Coordinate IT activities across the entire campus
2. Be responsive to the needs of all users
3. Provide a framework for planning for the future
4. Recommend resource allocations to central administration

As its purpose developed and was refined, the Information Resource Council became the sole organization on campus for recommendations to the university's vice presidents in the area of information technology and for participation in the university planning process. The cooperation and team work of all participants was key to the success of this model. Fundamental to achieving this spirit of cooperation was the restructuring of the Council to focus on broader issues and the expansion of the information technology user's role in the planning process.

The Council is divided into program groups which are composed largely of information technology users and are often led by users rather than information technology professionals. The Council's structure includes five program groups; each focused on broad areas of university concern–instruction, research, administrative systems, communication systems, and promotion of standards and cooperation. Each group reports directly the Council and elects its own chair. Members are appointed from the Council and from representative agencies such as the university's Faculty Senate. An overall Information Resources Strategic Planning Committee acts on behalf of the Council between regular meetings and approves all meeting agendas. Through its chair the Information Resource Council reports directly to a steering committee consisting of all university vice presidents. This steering committe is chaired by the provost.

University of North Texas Information Resources Council


Chancellor
Information Resources Steering Committee
University Planning Committee
Information Resources Council
IR Strategic Planning Advisory Group
Instruction Program Group
Research Program Group
Administrative Program Group
Communications Program Group
Standards and Cooperation Program Group
General Access Laboratory Committee

Program groups are directly involved in the planning process and in some cases may also be asked to implement decisions. As stated earlier, because they were intended to be broadly based, program groups include a mix of providers and users, staff and faculty, centralized and decentralized organizations. Each group participates in the development of its own structure. Program groups do not consist solely of IRC members, but users outside the IRC also are included to provide fresh insights.

A good example of diversity and projects addressed in the IRC is the Instructional Program Group. The goals and objectives of this group are to enhance teaching and learning through the use of information technology. Information technology includes such provisions as general access computing labs, computer enhanced video presentations, demonstrations, simulations, tutorials, video, distance learning, and access to libraries and knowledge bases. Using the instruction program group as an example, the following two cases illustrate how IRC program groups have created a more cooperative and effective approach to both the planning and management of information resources at the University of North Texas.

Cooperative planning for technology

Before the creation of the Instructional Program Group (IPG), planning for instructional technology to support instruction was problematic. Responsibilities for supported instructional technology were fragmented across colleges, the Instructional Media Center, Library, and facilities planning department. Communication among these various groups was limited. Faculty and students often had no mechanism for voicing their needs. This problem became most evident when the University remodeled its six largest lecture halls.

The Office of Facilities Planning carried out the renovation of the lecture halls. While the university architect tried to involve the university community in planning this renovation, the fragmentation of constituencies and the lack of a ready forum made this difficult. As a result, an outside consultant was used who was more familiar with an industrial model of instruction rather than an academic model. Consequently the renovation failed to meet the needs of those that used the classroom and great deal of "finger pointing" followed.

When the Instruction Program Group was created, one of its first charges was to "fix" the problem of the newly renovated large lecture halls described above. Because of its broad-based membership, the IPG was able develop very quickly the necessary dialogue that was lacking when the renovation took place. It organized itself into various study groups to carefully examine the problem and to gain an understanding of all the issues. These groups conducted intensive group studies with the user community. All the various campus technical experts were brought together to examine ways to improve the classrooms based on specific suggestions gathered from the user community. Soon accusations and conflict gave way to constructive suggestions. While all the problems in the newly renovated lecture hall weren't resolved, people began to feel more positive about the way in which the problem had been addressed. The development of a rational process for planning and dealing with classroom technology made them feel that this kind of problem would be less likely to occur in the future. Faculty and other users of technology now believed that they had an effective mechanism for airing their concerns and effectively addressing their problems.

As a result of its initial experience with the renovation of large classrooms, the Instruction Program Group decided to develop a long range planning agenda to address the university's instructional technology needs. In 1994 the committee undertook a multifaceted review of instructional technology on the UNT campus. This included a physical inventory of all major classrooms on campus to determine what facilities were in fact available in every classroom and what areas needed improvement. In conjunction with this physical survey, instructors were also surveyed to determine their perceptions of teaching in the various classrooms and what shortcomings the various classroom might have from their perspective. The group also reviewed the volume and nature of faculty requests for both equipment and media programs. This was done to not only get a sense of the changing trends in equipment and program usage, but also to determine areas needing increased support.

The final component of this comprehensive review was a focus group study of faculty from across the university. This focus group study examined the issues related to instructional technology with a greater depth than is possible with simple paper and pencil surveys. Groups discussed the needs and barriers that prevented the optimal use of instructional technology in the classroom. They indicated concern about keeping pace with other institutions and more importantly indicated strong recognition of the benefits to the teaching process that technology can provide. Not surprisingly, faculty in these focus groups also expressed concerns about the large investment which can be required in the development and use of technology. Finally, a number of suggestions were made by the focus groups about how to facilitate the use of technology across campus but also cautioned the administration against seeing technology as primarily a cost-saving endeavor or as the answer to all instructional needs.

The focus group component of the review was important for two reasons. First, it provided the administration a very direct, rich source of information about faculty concerns and views concerning instructional technology in the classroom. Second, it gave faculty an opportunity to consider the issues important to them in an in depth manner as well as a chance to get those views broadly disseminated.

Besides this multi-faceted review, the Instructional Technology Program Group activities addressed a number other critical planing concerns. They developed comprehensive guidelines for minimum technology standards for all classroom environments. They also developed a proposal for funding campus-wide innovative technology programs. This program was endorsed by both the IRC and the university vice presidents and at the time of this writing is in the process of being implemented. The group also developed a plan for funding the systematic replacement of outdated media equipment, which is pending university approval.

While not all the problems planning and developing the technology resources to support instruction have been solved by the creation of this program group, a much more positive and cooperative environment has resulted. More importantly, given the freedom and autonomy to operate as team brought together for a specific purpose, this group has proven to be remarkably dedicated and productive. And, as the case below will show, this federated approach to empowering teams to address problems has even been successful in the actual management of technology facilities.

Cooperative management of information technology--General Access Labs

The general access computing labs at UNT are operated by individual schools and other service providers under the direction of the General Access Laboratory Committee, a sub-committee of the Instructional Program Group of the IRC. The General Access Laboratory Committee is unique in that it has direct control of an annual budget in excess of a million dollars. This budget is distributed to its constituent laboratories for campus-wide laboratory operations. The General Access Laboratory Committee assumed operations of these laboratories when the University introduced a campus-wide student computing fee. At the time the fee was implemented it was originally thought that there would be a single laboratory, centrally administered by the university's computing center. Although some consideration was given to this model, it was clear the lab's need for new space might be insurmountable, and that there would be some duplication of lab activities already taking place in the schools and colleges. By creating a General Access Laboratory Committee with representation from each of the schools and colleges,the IRC was able to convince each of the school's deans to participate in a coordinated lab concept for the benefit of receiving central university support.

The first responsibility of the General Access Laboratory Committee was compiling standards across the university for lab administration. Sub-committees were formed to deal with issues ranging from equipment, service and software standards to security. Specific protocols were developed, as well as basic hardware and software configuration, hours of services, limitations of assistance, and related matters with the idea that a student could walk into any lab on the university and find a base line of common equipment, service, and software. Each individual school or college was also expected to emphasize both the software and services unique to its particular programs and missions. Thus, the laboratory in the College of Business Administration would have a larger group of business related software applications available, with lab monitors appropriate for its use while the College of Education would have greater concentration of equipment, software and services related to education and presentations.

The General Access Committee is an example where management of computing facilities is a shared responsibility between users and providers, and centralized and de-centralized organizations. The success of this model for coordinating diverse laboratories was successful as a result of leadership as well as the cooperation of its membership. The ability to share experiences among members, the efficiencies achieved by common practices, and the continued allocation of resources from the central administration acted as major incentives for this cooperation.

Other examples of cooperative efforts

The two examples above show how one program group, the Instruction Program Group, under the general umbrella of a university-wide council has been able to very effectively mount both a technology planning effort as well as take part in the management of technology resources. Other program groups have been able to achieve equally effective results. The Standards and Cooperation Group developed a proposal to equip all faculty and staff with at least a minimum base-line desktop computer. This proposal was approved, funded and scheduled to begin in the 1996. An even more dramatic example of the kind of cooperation that has developed out of the program groups is a recent joint proposal from the Research and Administrative Program Groups. Together they proposed the purchase of a new mainframe computer for administrative needs and additional centrally managed high-end computers to meet the needs of the research community. In the past, major computing upgrades had been contentious affairs–often creating a confrontation between academic and administrative interests. From the reports of those who had been involved in this process in the past, it was clear how well the groups had worked together to build a common solution and how quickly the decision was able to be made and endorsed by the entire university community.

Summary of UNT experience: A "federated" approach

The University of North Texas Information Resource Council and its associated program groups provide a model for cooperative activity for both information technology providers and users. Its capacity for high participation within a decentralized environment, unification of purpose and strategic planning stems from both the effectiveness of its organization and the dedication of its individual members. With information technology formally organized across three vice presidential units, and with the traditional divisions between administration and academia and between faculty and staff, a union of these forces around a common objective within the Council and its program groups serves to provide both meaningful user input and effective planning and decision-making functions. While there are clearly inefficiencies in such a model of organization, these need to be weighed against the value of direct user guidance and campus-wide support.

Acknowledgment

The authors gratefully acknowledge the work and support of all the members of the University of North Texas community who were an integral part of the success of this federated approach to information technology planning.

(E)merging Environments and Professionals: The University Center as Catalyst for GMU's Vision

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Five years ago George Mason University began planning a new building and a technology infrastructure that would serve as a catalyst for changing the teaching/learning environment at GMU. With the fall1995 move into the new building, these changes continue to provide a catalyst for program development, and for the development of faculty and staff involved in its use. They also have led to new working relationships among faculty, librarians, and computing professionals.

George Mason's University Center is designed to be the crossroads of the University, occupying the physical center of the evolving campus and playing a central role in the transformation of the university's learning enviroment. When fully occupied the building's eight acres of floor space will weave together space for innovative academic programming, a technologically-advanced library, sophisticated computing facilities, instructional and social spaces, selected student services, and a variety of food services and shops. To support this unique combination of elements, many new infastructures are being created, including an advanced wiring network and new organizational partnerships.

George Mason University is a state-supported metropolitan university located next to the nation's capital. A young, vigorous institution building toward the future, George Mason's reputation for innovation results from its intent to be a world-class university committed to meeting the needs of a highly sophisticated Northern Virginia community, often characterized as a prototype of the high-tech, information/service- based economy of a post-industrial, knowledge-driven era. The university is exploring new approaches to a variety of needs: new curricula for undergraduates, new advanced degrees supportive of the Information Age, new openings on the cutting edge of telecommunications, new arrangements between the corporate world and higher education, and new cooperative arrangements with state government agencies and the private sector. Founded in 1957 as a branch of the University of Virginia, GMU now has an enrollment of 21,774 students and 742 full-time faculty in a wide array of undergraduate and graduate programs.

4-8-2

New Curriculum in the University Learning Center

John S. O'Connor

Background on New Century College:
New Century College offers a BA and BS in Integrative Studies. The key words for the program, the cornerstones to build on, are interdisciplinary, integrative, collaborative, experiential, technology rich, and competency-based. The curriculum is structured around learning communities, experiential learning, undergraduate research, and course offerings in the other academic units of the University. In the first year, students take one highly focused, interdisciplinary course at a time. They "learn to learn" by developing critical thinking skills, multiple perspectives, and reflective practice. Ideally, it is a small college within a large university, offering the intimacy of the one and the resources of the other. Examples and illustrations of the program may be presented, time permitting.

University Learning Center
The University Learning Center embodies the ideals of New century College, offering the intimacy and community of the place and the connections to tap the resources of the rest of the University and beyond. The new building enhances the possibilities of two of the cornerstones of the program: pervasive technology and collaborative work spaces. We have combined the Learning Community model with intensive use of information technology. We believe that the computer has become the premier technology tool that enables us to work more efficiently and effectively. But more importantly, it allows us to work both more collaboratively and more independently mastering material at one's own pace. Computer use pervades the curriculum and pedagogy of New Century; it is the ground we assume is there when we built the College.

Examples of current computer use.

The physical layout of space in the University Learning Center encourages groups to meet in lounges, around tables in the food court or library. Within the New Century College space is a study area, with handouts, magazines, videos, and various items related to th current courses. The hope is to encourage informal, out of class contact among students in a learning context. For easy computer access, ports and reservable ethernet cards allow network connections from many spaces in the building. There are computers for library and internet access at the information desk and in the library areas. There are computer labs, a multimedia authoring center, and a planned simulation studio. Descriptions of these three facilities may be in the other talks; particular use in New century will be detailed here.

For the program to succeed, we constantly depend upon the smooth operation of the infrastructure--the library and the technology--and upon the imagination of the students, faculty, and staff. The pervasive high tech and flexible, communal space are the enabling environment. The overlapping of professional roles is also matched with the greying of the line of who is teacher and who is learner. Students have been successful teachers in the Instructional Development Office. Similarly, they become the teachers in each of the key technology facilities in the University Learning Center.

University Center Library
Charlene S. Hurt

The design of the University Center Library began with a charge from the President of GMU to "think about a library in a student union." At that time Fenwick Library was the only library facility on campus, and suffered from severe overcrowding of stacks and seating and badly out-of-date wiring and networking. Around the same time a select faculty committee on the future of libraries was meeting, and its final report emphasized three primary needs:

a. creation of a research library to support growing graduate programs
b. creation of a "teaching library" to help students achieve information literacy
c. use of technology to achieve excellence, rather than relying on development of a paper collection

Around the same time the university was engaged in rethinking the undergraduate curriculum, and librarians participated in teams working to design a new interdisciplinary, multicultural core. As part of that process, librarian held a retreat focused on our concerns that the needs of undergraduate students were being neglected in the push to support graduate-level research. Perhaps the most useful aspect of the retreat was a discussion of our individual memories of that moment when learning was most exhilarating - and the realization that those moments almost never took place in a library, almost always were in a collaborative environment, and frequently involved food and/or drink.

The process of planning a library in a student union, therefore, began with a desire to create a new kind of learning environment for undergraduates (and, coincidentally, free up the current environment for a more classical research library approach) and an interest in supporting new ways of teaching undergraduates that depended on collaborative learning, extensive use of media and technology, and an awareness of the growing diversity on our campus. So we proposed a "teaching library" that would have a paper collection supporting the undergraduate core but would also hold the entire media collection and, through its technology, have extensive access to materials in electronic format (there weren't many available then, but we were optimistic about the growth of electronic publishing). We also proposed a Student Authoring Center where students could incorporate media into their papers and presentations and a Media Distribution Center for distribution of media throughout the building and, potentially, the entire campus.

I need for a moment to describe the massive scale of this building in comparison to other buildings on campus - it is triple the usual size of construction project funded by the Commonwealth, with 8 acres of floor space, and it stands on the highest and most central point of the new campus growth, about one block from Fenwick Library. The size and location alone enable it to be central to the campus; our goal was to cluster activities in it that would assure that centrality, in order to give a "commuter campus" a heart. Fortunately for us, the University's President believed that a library should be at the heart of a university. The first transition we had to make was to believe that a library could be successfully located in the midst of food and commercial space and student service activities.

The big breakthrough in the design of the building occurred when the two major occupants of the building - the library and bookstore - agreed to develop vertically, so that a lively atrium could be created for food services and shops. The next breakthrough was when the library agreed to treat its book collection as an "open collection," shelved along the eastern sides of the upper two floors and not separated from the rest of the building. Suddenly we had an "agora," or, as some of our less reverent librarians say, a shopping mall.

During the development of the building plans four groups of players who barely knew each other participated in several joint planning sessions: library staff, computer services staff, student union staff, auxiliary services staff. Each planning team also had student and faculty representatives. One thing I learned is how dedicated staff from these areas are to serving students, and how often they share a common sense of not being heard or appreciated (the Rodney Dangerfield syndrome). We found we were natural allies on many subjects.

The University Center Library today encompasses four major areas:

An extensive multimedia collection with appropriate equipment and a multimedia service desk for assistance in using any "machine-using" collection, including online reserves
and full-text periodicals

A teaching/extended reference area for drop-in and scheduled instruction in various information sources and extended assistance in research. This includes a fully-wired interactive classroom seating forty at networked workstations.

A collection of books focusing on undergraduate learning and intentionally multicultural in content, interspersed with a variety of seating.

An Information Desk which is jointly managed with University Information Services and which provides information about the library, the building, and the university as a whole via a series of networked terminals and a University Center Home Page.

The library has a "controlled section" where media, reserves, periodicals, and reference books are shelved and where the primary service desks are located. All the seating in this area is wired and networked, and there are 56 "superterminal" workstations with high end networked computers and printers. Special facilities for disabled patrons and group viewing facilities are also available in this space. The "open library" contains sufficient shelving for 100,000 paper volumes and approximately 1000 library seats, 60% of which are wired for power and network connection. There are 32 small group study rooms, also fully wired. Distinctive carrels provide computer workstations, but the space is primarily designed for students bringing in their own laptops; networking cards will be checked out from technology services.

Over the years the University Center has evolved our working relationships have also undergone a transition, so that we now are working very intensively with University Computing, especially their Telecommunications group, and with Information Services. We continue to work with Student and Auxiliary Services, and have added the Center for the Arts for programming display and performance space. We expect these relationships to grow now that we're actively occupying the building. Perhaps most significant is our new partnerships with faculty, especially with New Century College, and our evolving role as part of the team of mentors students rely on as they work their way through college. Adjacent to the library is the Multimedia Authoring Center, about which Randy Gable will tell you more.

4-8-6

Infrastructure Support

Walter W. Sevon Jr.

The University Learning Center telecommunications infrastructure was designed to complement the work being done on the campus through the Communications Infrastructure Project. To understand and fully appreciate the University Learning Center infrastructure one must understand what George Mason University has done through the Communications Infrastructure Project.

Through the Communications Infrastructure Project the university is installing:

- A complete **underground conduit system**, with manholes, encased in concrete, that connect all 107 buildings on the Fairfax Campus. The system is sized to allow future growth and support GMU for 20 years.
  Statistics: 7.1 Miles of concrete encased conduit; 24 total miles of Conduit; 47 Manholes.

- An **interbuilding cabling system,** connecting all 107 buildings on the Fairfax Campus with fiber optic cabling, copper cabling, and coax cabling to support all data, voice, and CATV requirements at the Fairfax Campus. This cabling will be installed in the underground conduit system.
  Statistics: 588 Miles fiber; 30,000 copper pairs installed.

- **An intrabuilding cabling system** consisting of rewiring 90% of Fairfax Campus buildings with fiber optic cable and high capacity copper cabling (Unshielded Twisted Pair (UTP)) that will support the new voice system and current and future high speed data requirements.
  Statistics: 2,400,000 feet of the highest quality UTP.

- A new **high speed data network** backbone (interbuilding data network) and wiring concentrators (intrabuilding data network) for all GMU locations. A high speed Pilot Multimedia Network (ATM) connected to the data network backbone and the new Interactive Electronic Classroom. Our new data backbone can carry 40 times more data than today and improved service will be provided to all computer labs and all other network users. Students will now have data connectivity to the mainframe and access to the Internet from their residence.

- A **Video Distribution system** that will distribute 30 CATV entertainment channels and 10 additional GMU channels to all residence halls and all buildings on the Fairfax Campus. It will be possible to film a class/performance in any building and to broadcast it over the CATV network.

- An **Electronic Classroom/Distance Learning System** that includes 2 electronic classrooms at the Fairfax Campus and distance learning classrooms at the Fairfax and Prince William Campuses. Professors will be able to prepare multimedia presentations for their classes that can be delivered to the Electronic Classrooms over the CATV network, the Pilot Multimedia Network, or the data network.

- A new **voice system** that includes telephone systems (PBXs) at the Fairfax Campus, Arlington Campus, Prince William Campus, Commerce I & II, the Mathy house, and the

Center for Professional Development; links these PBXs together; and gives a single system image. The system includes over 3200 digital & analog telephone sets and also supports Integrated Services Digital Network (ISDN) capability. This system replaces the Rolm and Centrex service and will provide improved service levels at reduced cost to GMU.

- A new **management system** that will control the voice/data/CATV systems that will be based from a new Network Control Center located in Thompson Hall. This system will allow GMU personnel to rapidly reconfigure voice and data networks and give immediate support to students, faculty, and staff.

University Learning Center Infrastructure

The above is a good description of what the Communications Infrastructure Project will provide the university. The University Learning Center is an extremely large building and has a robust telecommunications infrastructure of its own which consists of the following:

- 740,000' of Category 5 UTP cable encompassing 4139 data/telephone outlets. The outlets are distributed throughout the center with a large percentage of the outlets located in public areas. 8.35 miles of installed fiber optic cable distributed to every Telecommunications Closet in the building.

- A high speed data network consisting of 880 Ethernet 10BaseT Ports and 48 10/100 MBs ports. The 10/100 MBs ports are used to segment the network and to support servers and other high performance workstations. 406 of the 880 Ethernet 10BaseT Ports are dedicated to the library, with most of the ports dedicated to public access terminals and positions within the library where students can bring their laptop computer and access the network. Additionally, ports are provided for public access in the coffee house and other public areas.

- The headend of the Video Distribution System is located in the center. There are 62 coaxial connections that can carry the GMU/CATV channels and they are distributed throughout the center in assembly/classrooms, meeting rooms, library video carrels, media viewing rooms, commercial spaces, and public lounges. The facility will allow assembly/classrooms in the center and classrooms throughout the campus to schedule and control VCRs, laserdisk, CD-ROM, betacam, audio cassette, and CD-Interactive sources. It is located adjacent to the library in order to have immediate access to the library media collections that can be scheduled to play at scheduled times on assigned GMU channels.

- A computer lab with 54 90 MHz Pentium computers, 25 PowerMac 6100/66 computers, and 2 handicap workstations. The computers will all have Internet access as well as access to a dedicated high performance server.

- A pool of laptop adapters that can be checked out to faculty or students when they bring in their personal laptop computers.

Media Authoring Center (MAC) - The MAC will provide an access facility with equipment, software and expertise to assist students and faculty in the preparation of media and multimedia based projects. The MAC will closely collaborate with the Instructional

Development Office and New Century College to ensure a comprehensive and consistent program of new media services for the campus. The MAC will have a video production studio, video editing stations, an audio recording booth, a sound editing station, and 5 multimedia equipped computer workstations (PowerMac 8100AV). The latter will have access to input from VCR, videodisk, CD-ROM, flatbed and slide scanning, and common audio sources. The emphasis will be on providing a migration path for the GMU community to move from analog presentations to full digital multimedia equipment.

The Faculty Development Perspective

Professor Michael R. Gabel

What Faculty Development is Becoming

What Comes First: The Technological Chicken or the Egg or the ???

Student Development: Literacy - Motivation - Expectation
Technology Development: Networks - Labs - Electronic Presentation/Interactive Classrooms
Faculty Development: Curriculum modification/enhancement - Culture change - Support

Faculty Development: A High Priority

George Mason University decided that Faculty Development was a high priority, and as a result, many faculty are both willing and able to incorporate into their teaching the resources of the Technologically Enhanced University Learning Center

The Process: Curriculum modification/enhancement

Early 1980's: The PAGE Program was inaugurated. This two-year Plan for Alternative General Education incorporated programmable calculators and e-mail on a Cyber mainframe. New interdisciplinary courses were created by the faculty for this program.

Mid 1980's: Computers and Writing. Sections of English 101 were revised to take advantage of technology

1994: New Century College (discussed earlier)

The Process: Culture change - Support: The Instructional Development Office (IDO)

Conceived by President George Johnson's "Project Team on Learning Initiatives," the Instructional Development Office (IDO) was established in the Spring of 1991 and is charged with bringing information technology to bear on the educational mission of the University.

The IDO is a faculty support facility, managed by faculty, serving the entire GMU academic community.

4-8-10

The IDO:

- •provides support for faculty in:
  - °designing courseware
  - °using the technology-enhanced classrooms
  - °applying computer-based communications to extend classroom discussion

- •manages a training/production computer/multimedia laboratory

- •teaches workshops in the latest tools for the application of technology to teaching

- •organizes discussion seminars on pedagogical and policy issues related to technology integration

- •tests and then recommends hardware and software solutions to the problems of creating and delivering technology-based learning environments

- •provides a range of video and graphics support: from basic editing and scanning to video production and computer animations

- •seeks partnerships with outside corporations and agencies which enable the production and dissemination of technology-based learning environments

- •contributes (via presentations, workshops, and demonstrations) to the ongoing national dialogue on the role and future of technology in teaching

Key Accomplishments:

- •Established a responsive, competent, well-funded facility which encourages and supports faculty to integrate technology into their teaching (established in Spring 1991)
- •Designed and managed the installation of four high-end technology-enhanced classrooms (1992)
- •Received a Virginia State Council of Higher Education Grant: "Infusing Technology into Teaching, Learning, and Community" ($115,000, 1994-96)
- •Instituted the "Showcase for Technology in Innovative Teaching" (1991, 1993, spring 1996 [planned for the University Center opening])
- •Organized Intensive Faculty Development Workshops:
  - °Early Adopters (25 participants, summer 1992)
  - °Summer 1993 at the IDO (110 faculty participants in study/development groups)
  - °Distance Learning Workshop (30 participants, summer 1994, supported by Bell Atlantic)
- •Taught workshops for faculty on teaching and technology (207 registrations this year alone)
- •Provided a focal point for innovative teaching for our faculty and visitors to the GMU campus

- ***How the IDO is getting ready for the University Learning Center***

Showcase for Technology in Innovative Teaching:

For the Opening Ceremonies (Spring 1996), the IDO will organize a showcase where faculty will demonstrate their use of technology in their teaching.

Technology Learning Competition (TLC):

The IDO has been involved in helping organize the TLC, for which teams of Faculty/Staff/Students/Community Members will create interdisciplinary projects designed to foster a sense of community involvement and to demonstrate GMU's links to local businesses, institutions, and agencies. Although this is an opening day event, it is expected that it will be continued each year.

Faculty Orientation Presentation: "The Student Paper of the Future"

We provided demonstrations to faculty of the kind of research paper (multimedia enhanced) that students will now be able to submit: created in the University Center Student Authoring Facility and submitted via the campus network.

The Web

We have been teaching a number of workshops for faculty on Web Publishing. We have also provided enhanced support to certain faculty who have been incorporating the Web into their teaching, with particular attention to faculty asking students to publish class projects on the Web.

In Short

The IDO is helping faculty to get ready to expect changes in both their students and in the University, changes that reflect the possibilities that the new technologies bring to teaching.

How The Future of Faculty Development Depends on

The UC Library + The Center Activities + The Infrastructure

Student Support/Help Facility

Finally, located in the University Center, there will be a technology support facility for students. Faculty have been hampered in their efforts to encourage students to apply technology to their learning, for to do so often required the use of valuable "class time." The IDO should now, finally, be able to say: "If you create it (or incorporate it), your students will be able to use it."

Raising Expectations of Faculty: The Network

"Don't Worry. – – As soon as the network is finished......" Faculty have been hearing this for quite a while. We are all wondering if the use and capabilities will be in synch. For example, as faculty hear that video will be distributed from the University Center Media Distribution Facility, they want it on their desktops, on their students' home computers, and in the classrooms where they teach. One of the deterrents to IDO's helping faculty to create and incorporate new digital materials has been that it was not so clear where the data would be stored and if the bandwidth of the network was sufficiently high to deliver reliably such materials. The new network is supposed to resolve this problem.

Raising Expectations of Faculty: The Data

What will we put on this new network? The range expected is from "not much more than we already do" to "everything." Faculty may expect that much of the Library resources will be digitized, if not momentarily then very soon. In addition, faculty will expect that the UC Library increase its purchases of digitally stored materials and that the Librarians work with faculty to created an innovative digital library.

Faculty-Student Teams: Creating New Teaching Materials

Currently, the IDO has been supporting faculty in the modest production of new teaching materials. Faculty have discovered that this process takes considerable time. Even more important, some have come to realize that the better model for these activities relies on the use of faculty/student teams. The new Student Authoring Facility will be the training grounds of those students who will eventually join such teams.

Student-Centered Learning

Many faculty are eager to create environments in which students take more responsibility for their own learning. That the new University Center is being called a Learning Center (rather than a Student Union) reflects this desire. Such a change requires efforts on both the faculty and the students. It is the faculty anticipation that the University Center, with its Undergraduate Library, its emphasis on Technology, its numerous breakout and study facilities, and, yes, its bistro, will indeed become such a facility.

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Proceedings for Annual Conference:

The Use of Groupware in the Reengineering of Business Processes

(to be delivered November 29, 1995)

BABSON
COLLEGE

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The Use of Groupware in the Reengineering of Business Processes

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Abstract:

The principles and business practices of reengineering and other change management strategies have been around for decades. More recently, practitioners have stressed the central role of information resource management and information technology enablement in achieving institutional reengineering objectives. This session takes an "in the trenches" view of these efforts, considering project management, change team composition, process modeling, and the performance metrics for both customer service enhancement and operating cost reduction. The session then considers in some detail the use of various collaborative I/T tools, including: electronic mail, electronic conferencing, and workflow-enablement software, as an integral part of these activities.

Richard M. Kesner, Chief Information Officer at Babson College and President of RMK Associates, Inc., will begin by briefly detailing a reengineering process model and its I/T underpinnings. To this end, he will address the institution's need for a formal information architecture and I/T infrastructure. With these capabilities in place, the institution will be positioned to move forward with a major change initiative.

Mr. Kesner will then apply this model as a lens to view Babson College's transformation efforts. This case study will include a discussion of the role of Lotus ***Notes*** as a collaborative tool; Banyan ***Beyond Mail***, Action Technology ***Action WorkFlow***, and Microsoft ***Visual Basic*** and ***SQL Server*** as tools for building informated and automated business processes; and ABT ***PowerCampus***, US Lan ***Fundmaster Financial Software***, and Sequitur ***Admission System*** as workflow-enabled applications. The following pages summarize the session's findings.

The Crisis in Higher Education - the Need for Change:

Many higher education leaders in the United States now believe that our colleges and universities face a major crisis. The components of this crisis are clear to us all:

- slow job growth and stagnant income levels.
- tuition growth at levels greater than the rate of inflation.[1]
- a rapidly growing gap between all sources of student funding and the capacity of students and their families to pay.[2]
- a radical change in student demographics, requiring higher costs to recruit, educate, and support.
- a Federal financial aid structure under siege by the government for what it costs and criticized by the public because it does not meet current need.[3]
- the more general loss of public trust in higher education.
- a questioning of the value and need of traditional higher education, encouraging the growth of work place alternatives.

Given these circumstances, it is clear that collegiate institutions cannot continue to operate as they have in the past. They must change or cease to exist. According to

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[1] Operating costs and the tuition and fees continue to rise. The mean and median undergraduate tuition and fees at independent institutions in Massachusetts rose over 11% each from 1991 to 1993 alone. Coupled with that, current fund expenditures for Massachusetts, New England, and the United States rose 93%, 93%, and 89.9% respectively from 1983 to 1990 while revenues decreased 90.1%, 89.4% and 86.4% respectively. The ***Chronicle of Higher Education***, the ***New York Times***, and many professional journals regularly report on the growing gap between the cost of a college education and the ability of the typical U.S. family to meet these financial requirements.

[2] For example, the amount of **unmet need** for undergraduate students at Babson College has risen from $73,000 in 1991/2 to a projected $851,000 in 1993/4 (an increase of over 1000%). If Babson were to fund this gap, it would have an immediate impact on revenues because 93% of all financial aid dollars are currently funded from general revenue (i.e. student tuition dollars).

[3] Nationally, a $2 billion deficit in the Pell Grant Program has reduced the chances for federal aid and hence a critical component in college funding for many students. Furthermore, between 1986 and 1992, the estimated total state grant aid awarded by Massachusetts dropped from $66,974,000 in 1986 to $39,989,000 in 1992. Here at Babson the financial aid budget underwritten by tuition and endowment dollars has grown by approximately 375% between 1986 and 1992. The College's ability to fund its financial aid program in light of other major strategic initiatives has diminished while the student need for financial aid has radically increased (from 32% of all undergraduates in 1989/90 to 49% today).

Myles Brand, President of the University of Oregon, colleges and universities have two options:

> ***First, members of the academy can debate possible reforms and then cautiously pursue them, which is a tack many of us prefer. Or second, we can challenge one another to think expansively and to debate bold new directions in higher education - directions that break from conventional paradigms in ways that range from creative to radical.***[4]

Babson College faces the same obstacles as the rest of higher education. Moreover, the College has adopted a long-range strategic plan that will rapidly propel them into the forefront of business education. This approach has and will continue to require significant resources - both human and financial, far exceeding the institution's current means.[5] For example, the remaking of the Two-year MBA program has positioned Babson College at the leading edge. The delivery of this program costs considerably more than its predecessor. Similarly, the College will need to invest more heavily in its undergraduate program as it is redesigned.[6] Though both of these efforts are critical to the immediate and future viability of Babson as an institution, neither will, in and of themselves, generate significantly increased revenues to cover the added costs of development, implementation, and ongoing support. At another level, the College requires full-time faculty, facilities, information technologies, and library resources far beyond those that complemented past modes of program delivery. These enabling services further raise the cost of overall operations.

In quantitative terms, the College currently requires nearly an additional $1.4 million dollars annually to develop and run its new educational programs. Capital, information technology, and library requirements are presently underfunded by approximately fifty percent (50%), another $1.2 million dollars annually. These figures cannot be offset by a growth in tuition and fees. In fact, to be competitive today, Babson is committed to annual increases in revenues pegged to the consumer price index. Furthermore, the College plans to reduce undergraduate enrollment to approximately 1600 by 1997/98, in line with the capacity of the institution's present and planned facilities. In short, while essential costs are going up dramatically, Babson lacks the ability to generate significant added revenues.

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[4] Myles Brand, "The Challenge to Change: Reforming Higher Education," Educational Record (Fall, 1993): 7-13.

[5] Most institutions of higher education rely upon endowment income as well as tuition dollars to cover their operating costs. Lacking a substantial endowment fund, Babson College must rely largely on its annual revenues to pay for both current operations and future program development.

[6] Graduate Dean Tom Moore has documented nearly a doubling in faculty contact hours in the new MBA program, pushing the costs of this program beyond his limited strategic development fund. Steve Schiffman, the Undergraduate Dean, has begun the planning for a new curriculum. It is clear from the already-established undergraduate cluster program that anticipated undergraduate teaching changes will also require substantial added resources.

Finally, since the College is dependent upon tuition dollars and will continue to be so, Babson must maintain its ability to attract and retain high quality students. While the redesign of both the graduate and undergraduate programs will address the academic requirements of our customers, recent data indicate that the delivery of student-related business services do not meet their needs.[7] Since these activities are central to student perceptions of the value of the Babson experience, the College must address these issues as part of its marketing and business strategies.

Developing an Action Plan:

In the spring of 1993, Babson College's President, William F. Glavin, appointed a Task Force of senior administrators, faculty, and reengineering experts to consider the role that a reengineering process might play in the development and success of the institution. On December 23, 1993, this working group reported back to the President, recommending the initiation of a reengineering effort that focused upon the enrollment process (i.e. the delivery of student administrative services, from initial inquiry through graduation and including such processes as admission processing, registration, student billing, and financial aid packaging). In making this recommendation, the Task Force emphasized the goal of significantly improving the quality of service delivered to undergraduate and graduate students. The report indicated that this goal was to be achieved through the radical redesign of said services while reducing their overall cost to the College.

On February 4, 1994 and at the recommendation of the Reengineering Task Force, President Glavin appointed a Reengineering Design Team (***RDT***). This group included: Richard M. Kesner, Chief Information Officer, as chair; Madge Lewis, Graduate Registrar, as co-chair (and as the designated Director of the reengineering implementation process); Connie Bosse, Associate Dean Undergraduate Studies; Keith Conant, Associate Director of Financial Aid; Carol Leahy, Systems Analyst; Mary Rose, Assistant Dean of Admission; Peg Abbate, Administrative Assistant to the CIO; and Gerry Shaw, consultant (and the former

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[7] Data sources examined by the Task Force in this regard, included: Inquiry Study (July, 1988, conducted by Maguire Associates, Inc.); Quality of Life Study of Current Students (October, 1989, by Maguire Associates, Inc.); Assessment of Student Life and Student Satisfaction (April, 1993, by Maguire Associates, Inc.); Survey of Undergraduate Recruiters and Managers (June, 1993, conducted by The Office of Quality, Babson College); Evening MBA Service Delivery Questionnaire (April, 1993, prepared by Michael D. Cohn); A Study of Diversity (1991, Abt Associates, Inc.); Alumni Study (1991, Pathfinders Research Group); and, interviews with President's Cabinet (November, 1993, conducted by P. Gerard Shaw).

Vice President of Student Affairs at another Massachusetts college). Kesner, Lewis and Shaw were assigned to the RDT on a full-time basis, while the remainder of the team devoted approximately 40% of their time to RDT business.

As set forth in the Reengineering Task Force's **Case for Action** and subsequently endorsed by the College's President and Cabinet, it was the assignment of the Reengineering Design Team to develop a detailed plan for the renewed delivery of student administrative services, i.e. all of those services that complement classroom academic experiences, including: admission, financial aid, registration, student billing, student loans administration, academic planning, field-based learning administration, career services, and so forth. This document was to present descriptive scenarios for a desired state, a plan for their attainment, and operating computer system prototypes.

The RDT reported back to the President and Cabinet (the College's executive management team) on June 30, 1994. At a Cabinet retreat, scheduled from July 12 to 14, 1994, the RDT presented its findings and demonstrated prototypes for a new student registration and academic planning system, a student information system, a student financial services and billing system, a student opinion survey system, and an electronic course catalog.

The Role of Information Resource Management (IRM):

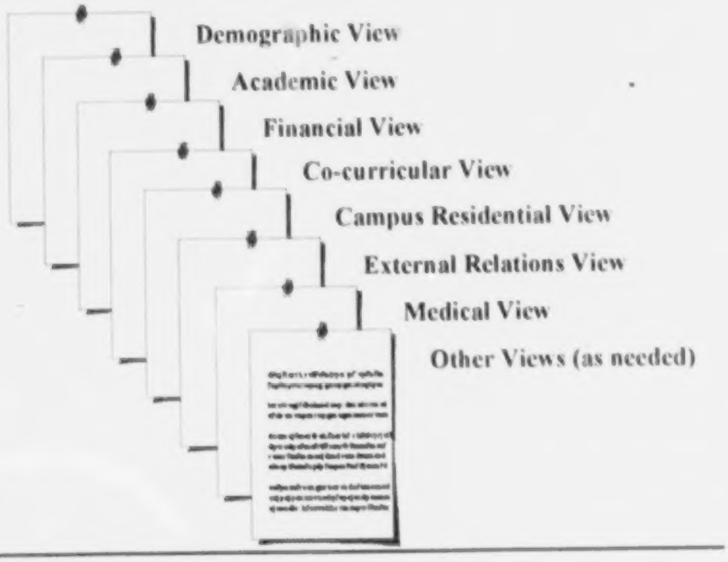
Throughout the reengineering design process, the RDT operated with an understanding that to succeed in this endeavor, the College required a completely new set of information tools. The actual data was already at hand but in a wide variety of inconsistent and largely inaccessible formats. To succeed in reengineering, the College needed an I/T infrastructure that afforded access to authorized users at any time and from both on- and off-campus locations. The computer hardware and software components of this solution were to facilitate broader information access.

At the start of the change process, a considerable amount of time around campus was invested in searching for information, rekeying data already stored elsewhere, verifying the quality and accuracy of information, checking the status of documents flowing within processes, and so forth. In the view of the Reengineering Design Team Chair, a radically different approach was required:

> ***To address this situation, Babson must develop a single, integrated information database that: (1) captures all relevant customer data once, (2) allows for and indeed prompts the information owner to update and/or validate his/her records, (3) provides easy access to authorized users, (4) affords the capability to ask questions, develop scenarios, and conduct trend analysis from the data easily***

and quickly, (5) affords multiple views of the data in its most current and accurate form, and (6) provides access any time and from both on- and off-campus locations.

The Multiple Views of the Student - to be Accessed on a "Need-to-Know" Basis by Authorized Information System Users



As depicted above, the ***demographic data view*** would be created by the student initially with system-driven reminders to keep this record current. Once created, any authorized person on- or off-campus could access this demographic information or a portion of it to service the customer. Similarly, the ***academic data view*** would come about as a function of information fed from automated systems (e.g. academic records and degree audit) as well as from actual data entry (e.g. faculty grades and advisor comments). Given the information-intensive nature of the higher education experience, each student would have many different views in that student's virtual (i.e. electronic) folder.

Investing in Information Technology Enablement:

To achieve the aforementioned information management objectives, Babson College required significant changes to its I/T systems and infrastructure. Starting in 1992, the College moved towards the implementation of a state-of-the-art electronic information network, based upon client/server technologies with these needs in mind. The new network (a.k.a. ***GlobeNet***) employs an optical fiber backbone, connecting all buildings on campus and running the Banyan ***Vines*** operating system. A variety of servers run both old (so-called ***legacy***) applications

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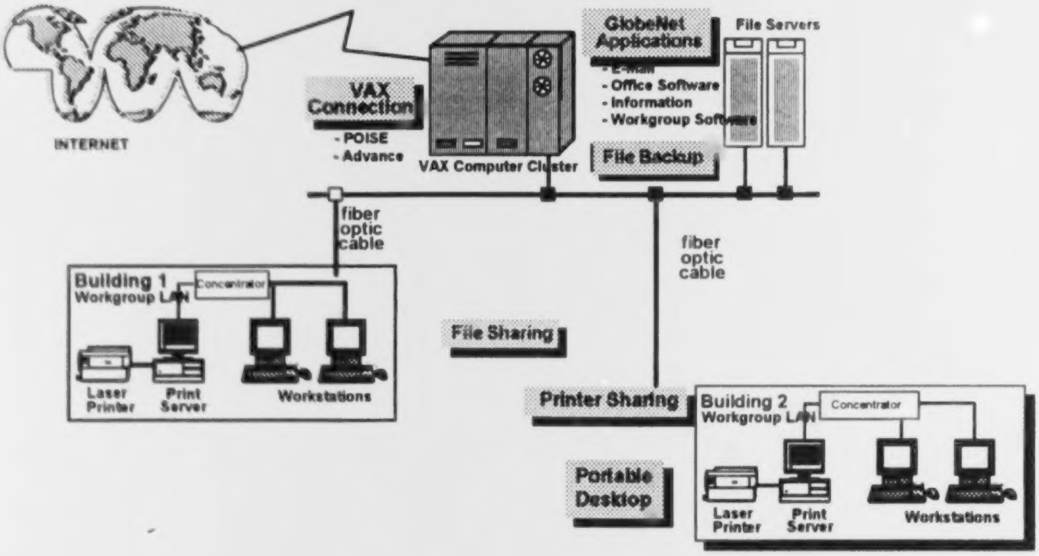
and new client-server-based applications via *GlobeNet*. On the client side of this equation, the College has replaced old desk-top units with standard 486 personal computers, running ***Windows*** and the Microsoft suite of office automation tools.

The overall network architecture conforms to open industry standards and will allow the College to move quickly, flexibly, and economically towards its new information systems and services objectives. This environment includes file and printer sharing, an electronic mail system that works in conjunction with its standard office automation tools, and cooperative ***groupware,*** such as Lotus's *NOTES* and Action Technology's ***Action WorkFlow***. Furthermore, the College has invested in the development of an information architecture as forward thinking as its network design.

Globenet Features


INTERNET
VAX Connection
- POISE
- Advance
VAX Computer Cluster
GlobeNet Applications
- E-Mail
- Office Software
- Information
- Workgroup Software
File Servers
File Backup
fiber optic cable
fiber optic cable
Building 1 Workgroup LAN
Concentrator
Laser Printer
Print Server
Workstations
File Sharing
Printer Sharing
Building 2 Workgroup LAN
Concentrator
Portable Desktop
Laser Printer
Print Server
Workstations

The information architecture plan is built around a data warehouse driven by a Microsoft ***SQL Server*** relational-database engine. At the present time, the College's ***legacy*** systems feed the data warehouse, but over time, new systems - some purchased for their outstanding client/server performance and others developed in-house - will replace the existing transaction systems. End user access to College data will come less frequently from these systems and more often from the data warehouse via a Babson College-built front end and the employment of off-the-shelf query tools, such as Microsoft ***Query***.

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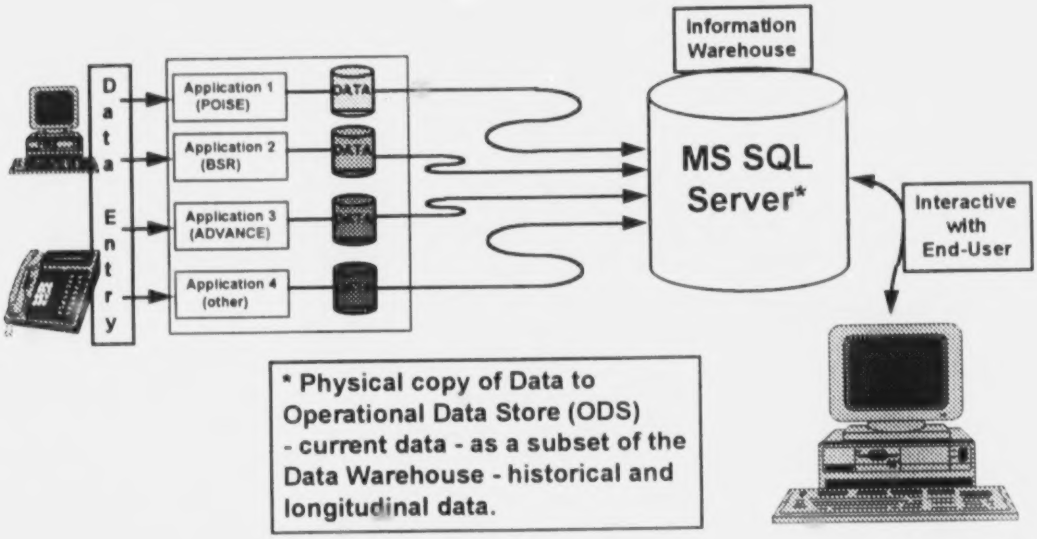

* Physical copy of Data to Operational Data Store (ODS) - current data - as a subset of the Data Warehouse - historical and longitudinal data.

Like the College's office automation tools, these front ends will employ an easy-to-use, point-and-click, graphical user interface (GUI). Thus, all of the information systems will have the same look and feel, facilitating cross-functionality and training. Through this strategy, Babson may replace transaction systems without affecting the end user's information views and business processes. More importantly, as the College reengineers, it will not be restricted by the limitations of functionally-focused information systems. The data warehouse provides the flexibility needed to fashion new information views quickly and economically as business processes change.

Babson's Groupware Strategy:

The success of Babson's reengineering efforts depends upon the timely delivery of effective and efficient I/T tools. Some of these products, particularly Lotus ***Notes*** and Banyan ***Beyond Mail***, play a critical role in the actual change management process by facilitating information sharing and collaboration. Others, like ABT's ***PowerCampus***, US Lan's ***Fundmaster***, and Sequitur's ***Admission System*** provide the College with state-of-the-art, workflow-enabled, client-server software. Still other products, including Microsoft's ***SQL Server***, ***Access***, and ***Visual Basic***, afford both campus I/T specialists and end users the means to present, capture, share, and analyze information in line with the operation of reengineered business processes.

Thus, as part of its change management strategy, Babson has positioned itself to leverage these technologies as part of a larger information architecture plan. Simply stated, this design separates the access and operation of transaction-based applications from customer views of data. It also offers a powerful and efficient

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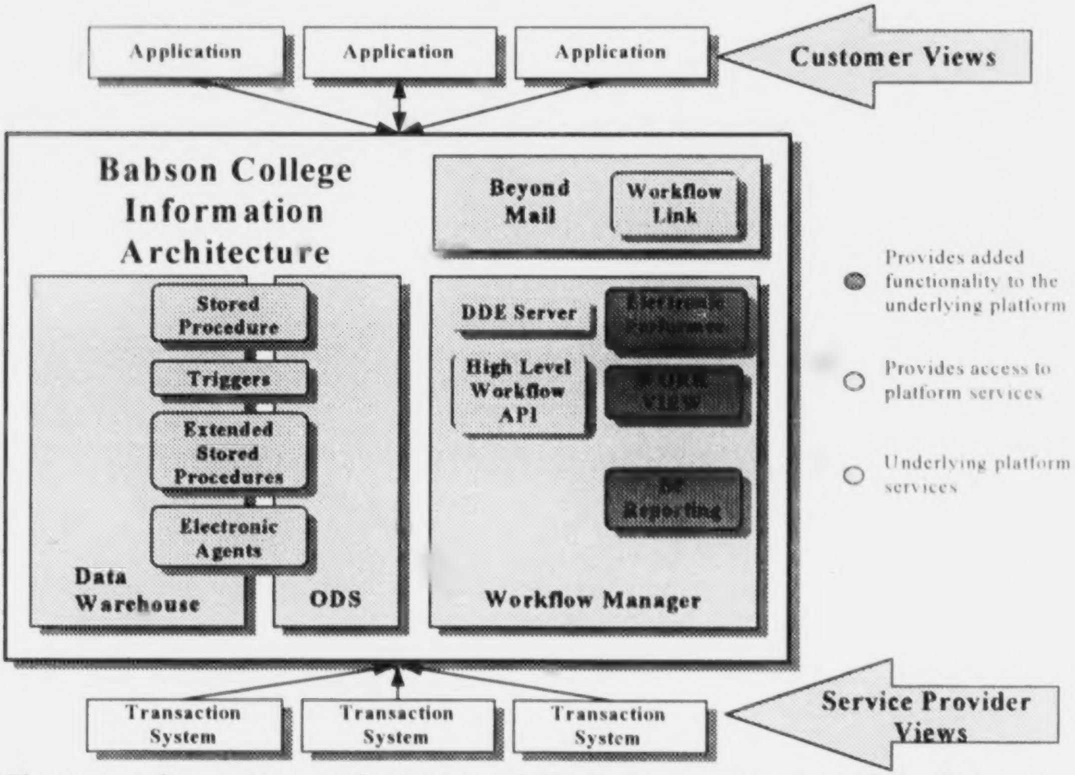
family of workflow-enabled products (a.k.a. ***middleware***) to informate and automate processes. The following graphic summarizes this architectural design:


Application
Application
Application
Customer Views
Babson College Information Architecture
Beyond Mail
Workflow Link
Stored Procedure
Triggers
Extended Stored Procedures
Electronic Agents
Data Warehouse
ODS
DDE Server
High Level Workflow API
Workflow Manager
Provides added functionality to the underlying platform
Provides access to platform services
Underlying platform services
Transaction System
Transaction System
Transaction System
Service Provider Views

The transaction systems at the bottom of the diagram represent products that are used, owned, and controlled by specific service providers, such as Accounting, Admission, and the Registrar. The data from these systems reaches the end user (students, faculty, and staff) via a complex ***middleware*** layer. The operational data store (ODS) serves as the repository for current data from transaction systems and the data warehouse serves as its cognate historical repository.

Groupware plays an integral role in the delivery systems built into this design. For example, stored procedures within the ODS and data warehouse may be triggered by specific events (e.g. the closing of an accounting period) or a specific date (e.g. the end of registration add/drop). These triggers automatically release formatted data to the end user (e.g. financial reports, class rosters). At a more sophisticated level, an electronic agent or "performer" will look for certain conditions to exist and will then take action as governed by its program. For example, an agent will periodically remind faculty to submit their grades and students to pay their outstanding account balances. Once the faculty member or student has fulfill his/her obligations, the messaging will stop.

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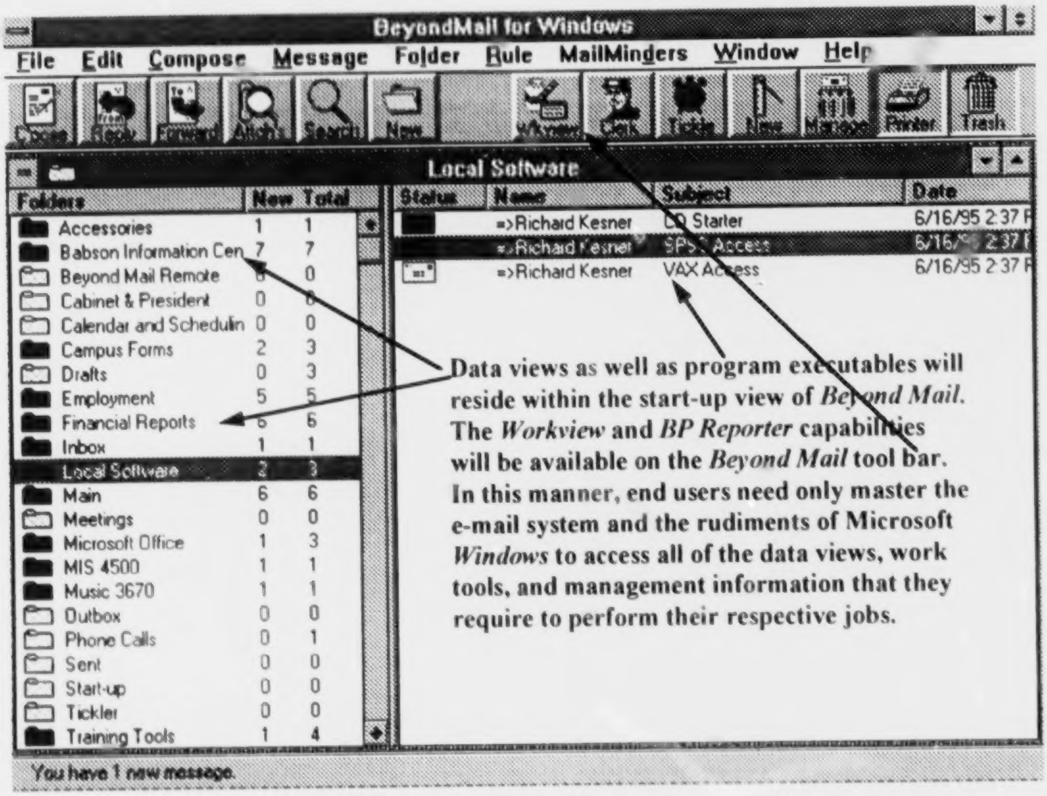
The architecture's workflow-enabled design is most manifest in two other system components: ***Workview*** and ***BP Reporter***. Workview is a user front-end to ***Action WorkFlow*** that lists all the work in an individual performer's work queue. The ***Workview*** product identifies the type of response required (a.k.a. the allowable act(s)) and the priority status of the task. This tool will allow service providers to better manage their daily assignments as it expedites action within business processes. The ***BP Reporter*** monitors processes, service providers, and process conditions of customer satisfaction. For any given process, it identifies all activity in terms of specific performance metrics. This tool provides a graphical representation of processes team performance along with a drill-down capability to ferret out the root causes of performance problems.

The last major component of the Babson information architecture design is electronic mail. We chose our e-mail product (Banyan ***Beyond Mail***) because it possesses both an electronic forms utility and a workflow enablement capability. Babson is integrating the delivery of most information services through this tool.



Folders	New	Total
Accessories	1	1
Babson Information Cen	7	7
Beyond Mail Remote	0	0
Cabinet & President	0	0
Calendar and Schedulin	0	0
Campus Forms	2	3
Drafts	0	3
Employment	5	5
Financial Reports	6	6
Inbox	1	1
Local Software	2	3
Main	6	6
Meetings	0	0
Microsoft Office	1	3
MIS 4500	1	1
Music 3670	1	1
Outbox	0	0
Phone Calls	0	1
Sent	0	0
Start-up	0	0
Tickler	0	0
Training Tools	1	4

Status	Name	Subject	Date
	=>Richard Kesner	CD Starter	6/16/95 2:37
	=>Richard Kesner	SPSS Access	6/16/95 2:37
	=>Richard Kesner	VAX Access	6/16/95 2:37

You have 1 new message.

Data views as well as program executables will reside within the start-up view of *Beyond Mail*. The *Workview* and *BP Reporter* capabilities will be available on the *Beyond Mail* tool bar. In this manner, end users need only master the e-mail system and the rudiments of Microsoft *Windows* to access all of the data views, work tools, and management information that they require to perform their respective jobs.

With Lotus ***Notes*** databases, the Babson ***Worldwide Web*** utility, and a number of workflow-enabled transaction system, this I/T environment is now ready for the new business processes emerging from the College's reengineering efforts.

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BUSINESS PROCESS REENGINEERING: A CONSORTIUM APPROACH WITH END USERS AS THE ARCHITECT PRODUCES DRAMATIC RESULTS

by Florida Community College Software Consortium
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ABSTRACT

Business process reengineering teamed with technology produces dramatic results. Legacy software is transformed into systems, architecturally designed by users. Learn how eight Florida community colleges, which are very diverse, combine fiscal and human resources, through a consortium and vendor partnership, to develop mission critical applications.

The Consortium in partnership with Software AG is using a Rapid Application Development (RAD) methodology to concurrently develop integrated Finance, Student Information, Personnel/Payroll, and Facilities systems. Specialized design teams combine the end user architect with Consortium and Software AG system design experts. These baseline applications will be stored in a central repository and maintained by consortium teams.

BUSINESS PROCESS REENGINEERING: A CONSORTIUM APPROACH WITH END USERS AS THE ARCHITECT PRODUCES DRAMATIC RESULTS

FLORIDA COMMUNITY COLLEGE SOFTWARE CONSORTIUM

I. INTRODUCTION

A. EXISTING SITUATION

The 1990s present a variety of critical challenges to all institutions of higher education. Legislated mandates from both the State and Federal governments arrive with increasing frequency. At the same time, funding from both sources to implement these mandates is shrinking. The demographics of the student population is changing dramatically as a decrease in the number of traditional students is offset by an increase in non-traditional learners.

As a result, most community colleges have been forced to find even more cost-effective ways of doing business. In this rapidly changing and increasingly complex environment, we have come to rely on automated systems to support management decision making and to provide improved student services.

Not only are new systems required, but a new way of developing and maintaining systems is required if the Consortium is to meet the pressing challenges of today's higher education environment. Several factors make this so:

-- Current software systems are in place, stable, and functional, but are nearing the end of their life cycles. They are written in languages using design features that are out-of-date and make maintenance complex.

-- Most of these applications either do not fully meet current requirements, or do not exist at all.

-- Although many requirements are common to all the members of the consortium, each member currently develops and maintains its own systems.

-- The time and cost to develop new systems is excessive.

B. CONSORTIUM HISTORY

The 1994 State Legislature appropriated $4.25 million to enable the community colleges and the Division of Community Colleges in the Florida Department of Education to begin compliance with 1987 proviso language requiring the planning and designing of student, personnel, and financial data bases. The appropriation emphasizes and rewards sharing of development activities.

As a response to the Legislature, eight of the twenty-eight Florida community colleges formed the Florida Community College Software Consortium (hereafter known as FCCSC or Consortium) to work collaboratively to develop the four mission critical applications of Financial Management, Student Information, Personnel/Payroll, and Facilities.

The organizational base for the FCCSC is that each of the member colleges has in its software inventory common software products. The FCCSC's common inventory of Software AG (hereafter known as SAG) products allows the member colleges to work in a collaborative atmosphere to meet State mandates.

The decision the FCCSC had to make was whether to purchase a packaged system or develop new systems. Each member college agreed that it wanted systems which would meet State, Federal, and College requirements, but also systems written with tools that could be easily managed, changed and enhanced by the colleges in the future. Existing packages did not meet all of the above requirements. As each college owned SAG products, it was decided the systems should use these tools to develop the new systems.

The participating community colleges are Broward CC, with 26,151 students; Edison CC, with 9,736 students; Florida CC at Jacksonville, with 21,840 students; Indian River CC, with 12,511 students; Miami-Dade CC, with 47,060 students; Okaloosa-Walton CC, with 6,547 students; Palm Beach CC, with 19,022 students; and Tallahassee CC, with 9,902 students (October 1994 Headcount). Together, the full-time equivalent (FTE) of these eight community colleges represents 47.8% of the FTE of the Florida community college students. The logistics of the project are difficult as the distance between the colleges varies, i.e., Okaloosa-Walton CC to Miami-Dade CC is about 609 miles while Miami-Dade to Broward CC is about 22 miles. The fact that colleges, so very different in size and located geographically far apart, voluntarily choose to work together on such a large project is in and of itself significant.

C. WHY FORM THE CONSORTIUM? . . . THE BENEFITS

This diverse group of colleges formed the consortium for the following reasons:

- Meet state data base requirements. When state level data is in integrated data bases, it is absolutely necessary for the colleges to have easily accessible and modifiable integrated data for planning.
- Provide long term solutions. Each college could apply a "band-aid" to meet current state mandates, but this would not help meet additional requirements in the future.
- Develop integrated mission critical applications. Colleges must have integrated data for planning and reporting.
- Gain rewards for sharing development:
  - -- Attain project management expertise. It is needed because the Software AG tools and RAD methodology were new for all the member colleges.
  - -- Build consensus from consortium business expertise. The knowledge gained from a team is greater than from an individual college.
  - -- Increase technical staff expertise. As Software AG tools are new, the technical staff of the colleges gain expertise from working in the Consortium.
  - -- Gain cooperative support for future enhancements. The sharing of knowledge and resources will help with future enhancements or modifications.

D. HOW WAS THE CONSORTIUM FORMED?

- College leaders worked with legislators for funding.
- College leaders encouraged other colleges for support and participation.
- College leaders met to formalize the agreement and to develop the plan.
- College leaders agreed to form a vendor partnership to provide management expertise.

II. PROJECT SCOPE

The Florida Community College Software Consortium is seeking to enhance four mission critical systems as a first step in addressing the critical challenges. These Administrative Systems under development between February 1995 and January 1997 include Personnel/Payroll, Student Information, Financial Management, and Facilities.

- Personnel/Payroll includes: Applicant Tracking, Demographics, Job assignments, Benefits, Position Accounting, Payroll, Time Accounting, FTE Accounting, Data Base Transmission, and the General Interface.
- Student Information includes: Admissions, Registration, Records, Curriculum, Fees & Tuition, Degree Audit, Data Base Transmission, and the General Interface.
- Financial Management includes: General Ledger, Purchasing/Receiving, Accounts Receivable, Accounts Payable, Budget, Data Base Transmission, and the General Interface.
- Facilities includes: Inventory, Scheduling, Data Base Transmission, and the General Interface.

The software tools used to develop the applications are NATURAL, CONSTRUCT, and PREDICT. The data base of choice is ADABAS. Other data bases may be used provided that the version of NATURAL employed provides an ADABAS view of the data and supports most ADABAS data functionality. The systems being developed are being tested on the MVS, VSE, and AS/400 platforms.

III. PROJECT ADMINISTRATION

Developing four baseline applications is a complex task being carried out over a two-year period. In order to make sure that the desired results are obtained within the time frame and budget specified, a carefully structured business plan was implemented. The following section describes the major steps that were necessary to achieve the results described in this proposal.

1. Created Executive Committee
   An Executive Committee was formed with one member from each college, as appointed by the Presidents of the respective colleges.

   The Executive Committee is responsible for:
   - Reviewing business plans.
   - Setting priorities and directions.
   - Developing Consortium project plan.

- Assigning appropriate personnel to teams.
- Overall administration and supervision of the Consortium.

The chair is responsible for coordinating all Executive Committee activities. The fiscal agent is responsible for handling all financial aspects of the Project, including all required reporting. The Executive Committee hired a Project Director who shall assume day-to-day responsibility for refining and implementing the overall systems development plan. The Committee meets regularly to review project progress, provide guidance, and help resolve issues. Committee members represent the interests of their respective colleges in obtaining the goals of the consortium. The Committee approves all expenditures of funds prior to disbursement by the fiscal agent.

2. Selected a Technical Committee

The Executive Committee established a Technical Committee with one representative from each college. The responsibilities of this committee are to provide technical expertise and support for the Executive Committee and to act as direct liaison with the Project Director.

3. Selected End User Representatives

The Executive Committee selected a group of end user representatives to serve as functional analysts for each application. One representative and approved participants was selected from each member institution for each application or component of an application.

The functional analysts shall provide information about State, Federal, and Consortium requirements for each application. They shall work with Consortium and Software AG technical experts to design systems which meet all of the above. The functional analysts, who are the users, have the primary responsibility for ensuring that the finished systems meet desired goals. They are the ARCHITECT of the software.

4. Developed Final Project Plan

The Executive Committee has developed a high level Project Plan. This plan defines the major components of each application, establishes development priorities, and schedules major project milestones and deliverables. This plan provides organizational guidance for the production of the project.

5. Established Electronic Connection

In order to assure action and complete participation in project development, each consortium member college is electronically connected with a minimum speed of 56KB. Connectivity also results in major savings through reduced travel. Consortium development is being accomplished using the computer facility at Miami-Dade Community College.

6. Rapid Application Development (RAD)

The Consortium selected RAD as the development methodology of choice. "RAD (Rapid Application Development) refers to a development lifecycle designed to give much faster development and higher-quality results than those achieved with the traditional lifecycle." James Martin, _Rapid Application Development_.

7. Created RAD Teams

Consortium and Software AG system design experts are assigned to work with each group of functional analysts, users. Software AG staff is thoroughly familiar with the techniques of RAD. Each RAD team combines extensive knowledge of the application, provided by the functional analysts, with strong technical expertise of the system design experts. This ensures that the final systems are technically sound, meet user requirements, and can be modified and maintained for the future.

8. Held Joint Requirement Planning Sessions

The first task for each RAD team was to participate in a Joint Requirement Planning session. This session was coordinated by a Software AG project manager. The objectives of this session included:

- Defining the scope of the project (defining what was to be accomplished).
- Defining high level system requirements.
- Developing an application "build plan".

All of the above was reviewed and approved by the Technical Committee. During this stage, Software AG conducted FASTRACK training sessions to facilitate the prototype development and to train Consortium technical staff.

STEPS 9 THRU 13 ARE IN THE FINAL PHASES OF COMPLETION.

9. Hold Joint Application Design Sessions (JAD)

JAD sessions are held for each of the major application areas. The purpose of these sessions is to further refine the requirements begun during the Joint Requirement Planning sessions. During these sessions, functional analysts, working under the guidance of Software AG experts, define the data each application needs to capture. Relationships between data are explored and clarified. The relationships and flow of information among organizational units within each college is defined so that relationships among applications are understood.

The first JAD session for each application area lasts about five days and includes the development of the following:

- Entity Relationship Diagrams, showing what information needs to be collected and how it is related to other information.
- Process Flow Diagrams showing how business is processed among the components of the organization.

10. Develop Application Prototypes

JAD sessions produce sufficient data about each application to enable Consortium and Software AG technical staff to quickly develop system prototypes. Software AG technical staff have certain assigned responsibilities for developing applications and management. Application prototypes are built quickly, incorporating only high level requirements as the goal of this first round of prototyping is to ensure that development is progressing correctly. If the development direction needs to be adjusted, it is done at an early stage with little loss of investment.

11. Evaluate Application Prototypes

Once each application prototype is completed, it is presented to the functional analysts for review and approval. Other members of the Consortium may also be asked to participate.

These prototypes are reviewed to determine requirements such as the following:

- All required data elements are present.
- The screens are well designed.
- Navigation is appropriate and easy to use.
- All required functions are present.

12. Hold Additional Joint Application Design Sessions

The comments from the prototype review are incorporated into subsequent JAD sessions. During these JAD sessions, requirements are further refined and additional details shall be added. Again, these sessions are conducted under the direction of Software AG experts using the knowledge and expertise of the functional analysts. Unlike the first JAD session, these sessions last one to two days.

13. Revise Application Prototypes Until Complete

After each round of prototype evaluation and JAD sessions, Consortium and Software AG technical staff enhance the prototype so that it meets the additional requirements as needed. Approximately 6 to 9 rounds, or iterations, are required to develop an application ready for implementation.

14. Approval of Applications

As the baseline modules are being completed, in addition to being tested on the development platform, they are being cross-tested at a designated site for each different platform/operating system environment within the consortium to ensure full portability of common baseline code. The Quality Assurance Director is responsible for ensuring the completion of this task. Testing of batch processes (jobs) require that operating system control language procedures (JCL) be converted/developed for each environment. These different control language procedure (JCL) versions then become a part of the baseline applications for the repository and future consortium maintenance. The completed baselines are approved by the Technical Committee to ensure compliance with established technical standards. The approved products are then certified by the Executive Committee chair to the fiscal agent for payment.

15. Install Applications In Central Repository

Once each application has been completed, it will be installed in a central repository. The repository will be the location where all the baseline applications are stored and maintained. From this central location, subsequent versions of program modules shall be distributed to Consortium members. The repository site has not been finalized. It may be at one of the Consortium colleges, or as an alternative, it could be located at Software AG's corporate headquarters, located in Reston, VA.

16. Distribute Applications

The next step in the process is to distribute applications to the member colleges. Each college shall get the same set of programs for each application.

17. _Customize Applications_

Once each college has installed the baseline applications, a functional analyst shall provide an application walk-through for interested staff. No customization shall be needed to meet State and Federal mandates. However, customization may be needed to meet specific college requirements. For example, this could include interfacing the new systems to subsystems, equipment (i.e., POS Terminals), and/or other applications existing at the institution.

18. Train End Users

High quality end user training is absolutely essential to achieving system goals and objectives. Training design shall begin during the latter JAD sessions.

19. Maintain Applications

Maintenance of an application is a critical, though often overlooked, aspect of system planning. By developing baseline applications that meet shared requirements, the FCCSC shall create an information processing environment which minimizes the effort required for maintenance. As State, Federal, or Consortium requirements change, the baseline applications and associated documentation will be modified at the central repository. Consortium colleges may assign resources to maintenance teams to make the required modifications. These modifications with documentation will then be distributed to all Consortium members. Thus, teams will be able to keep all Consortium members in compliance with mandates.

IV. THE PROJECT ORGANIZATION

A. CONSORTIUM AND VENDOR PARTNERSHIP

The project has been set up as a partnership between FCCSC and Software AG. Each staff member allocated by FCCSC is regarded as an equal member of the project team and schedules tasks accordingly. SAG has undertaken the management role, supplying a project director, a QA director, data base manager, three project managers, technical project leaders and information specialists.

It is for this reason that SAG will apply strict project management at all times and will need the total commitment from the FCCSC management team. The management of the day-to-day activities on the project is the responsibility of the Project Managers and they in turn are managed and directed by the Project Director. FCCSC staff are assigned tasks by the Project Managers and are expected to complete the assigned tasks competently. Non-task-related management issues, such as performance, attendance, leave and other problems are performed by the Technical Committee members, with input from the project managers.

B. ORGANIZATION AND FUNCTION

Some of the following were described earlier in III Project Administration # 1- 3, but again will be highlighted here.

Executive Committee	The Executive Committee has the overall authority for the project. They are responsible for reviewing business plans, and setting priorities and directions. They have the final approval for the allocation of resources, funds and personnel; the progress of the overall project; and changes that must be made to the project plan.
Technical Committee	The Technical Committee provides support for the

Executive Committee by handling month-to-month authority, performing technical oversight, assuring adequate resources on the projects. They also act as the direct liaison with the Project Director.

Project Director	The Project Director has the day-to-day responsibility for refining and implementing the overall plan, managing the project, maintaining the project budget, and reporting progress to the Executive and Technical Committees.
Quality Assurance Director	The Quality Assurance Director reports to the Project Director and is responsible for coordination across all applications and the portability of baselines across all platforms. As baseline systems are customized for Consortium members, the QA Director will ensure the applications remain maintainable.
Data Base Administrator	The Data Base Administrator reports to the Project Director and is responsible for designing data base and file structures which support efficient processing for each application while also observing restrictions and limitations of versions of NATURAL which support most, but not all, ADABAS data functionality to ensure cross platform compatibility.
Project Manager	The development of each application shall be directed by a Project manager. The Project Manager reports to the Project Director and is fully responsible for overseeing the day-to-day operation of the development of an application, i.e., the student system.
Information Specialist	The role of the Information Specialist is to provide programming support, provide technical expertise, and to provide systems support. Each application shall have access to a lead information specialist from Software AG. This person reports to the Project Manager for the system and ensures the appropriate use of Software AG tools.
Users, the ARCHITECT	USERS ARE NO LONGER ONLY CONSULTANTS; THEY ARE FUNCTIONAL ANALYSTS, THE ARCHITECT! The User Representatives are functional experts, from the colleges, who are throughly familiar with the requirements for an application. It is the User Representative's primary responsibility to ensure that the final applications meet all State, Federal, and Consortium common requirements. They provide systems specifications, create consensus on issue

resolution, review development, test products, provide user documentation, and train secondary staff.

Development Teams Development Teams are comprised of Consortium and Software AG technical staff as appropriate. Their tasks are to implement the results of the JAD sessions. They work with the User Representatives to create and enhance application prototypes.

C. RESOURCE SUMMARY

The following summary of resources shows the level of commitment of top management from the member colleges. Yes, new funding, which served as an incentive to begin the project, was provided by the State. This new money, mostly used to fund costs for the SAG partnership, covers only a portion of the costs. The college dollars and personnel are being allocated from current resources by shifting priorities.

PERSONNEL	NUMBER	
-- Colleges Technical Staff	27	F/T
-- Colleges User representatives	120+	P/T (10 - 50%)
-- Software AG staff	19	F/T
FINANCIAL (estimated cost to complete)		
-- Colleges	$11.3 million	
-- State	$2.7 million	

V. CRITICAL SUCCESS FACTORS

The Florida Community College Consortium and Software AG partnership is committed to meeting the State integrated data base requirements, within the resources and directions provided, using the following:

- Cost-effective application development.
- Fully functional applications delivered in less time than with traditional approaches.
- Protection of the Consortium investment should members need to change technical platforms.
- Reduced maintenance costs.
- Applications which can easily be modified to meet ever-changing regulations.
- Effective training for consortium technical staff.

The project will be successful when the following criteria is met:

- Completion of the applications under development within budget and on time.
- Systems to satisfy the user requirements within the scope of the baseline.
- Cross-platform compatibility for all systems (MVS, VSE, AS/400).

- Properly trained users.
- Detailed documentation.

VI. RESULTS AND DIRECTIONS

A. RESULTS OF THE ENGINEERING PROCESS

- Users are the architect of their Information Systems.
    - -- Users become the owners of their systems and data and become their own systems experts.
- Fully integrated applications are delivered in dramatically less time.
- Application development is more cost-effective.
- Investments in applications are protected across multiple platforms (MVS, VSE, AS/400).
- Application maintenance costs are reduced.
- Technical expertise is provided by vendors.
- Technical staff are expert at application development.

B. ACCOMPLISHMENTS DECEMBER 1994 TO PRESENT

- Plan defined, accepted, and funded.
- Contracts signed.
- Staff organized and in place--SAG and FCCSC.
- Eight colleges inter-communicating.
- Miami-Dade Community College development site operational and used for all development.
- High-level specifications defined for all systems.
- Detail specifications were developed for the Personnel/Payroll, Student Information (Admissions, Registration, Curriculum, Fees and Tuition), Financial Management, and Facilities.
- Construction for the Personnel/Payroll, Student Information (Admissions, Registration, Curriculum, Fees and Tuition) and Financial Management is on schedule for completion December 1995.
- College Implementation/ Steering Committees beginning to meet.

C. UPCOMING CHALLENGES

- Holding to the development plan's scope, time and budget.
- Implementation of the applications under development.
- The future after this baseline development is complete.
    - -- To continue funding.
    - -- To continue commitment of staff resources (business and technical) to the FCCSC by its member colleges.
    - -- To continue commitment to the RAD process.
    - -- To finalize plans for the Consortium organization, for future enhancements and maintenance.
    - -- To develop the financial aid component.
    - -- To integrate the library database component.

D. CONCLUSION

This project is already a success in that eight very diverse community colleges are working and sharing together. It will continue to be successful because, along with the enthusiasm of the colleges and the need and desire for the products, this project has three criteria required for success. They are:

- --- The project must be organized and managed so successes occur along the way, not just at the end. RAD is our methodology.
- --- The project must have support and direct involvement of the users. Our users are the ARCHITECT.
- --- The project must have top management support. Look at the commitment of the college resources by top management. They are committed!

Our dynamics and momentum are strong! Every member college believes in our success!

Wireless Networking at Ohio State University

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As networking becomes increasingly complicated and expensive, so does the decision-making process. The decision to go wireless can be even more complicated. This presentation will discuss Ohio State's current status, connectivity problems, planned solutions, and describe the network and its capabilities.

Wireless Networking at Ohio State University

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Current Status

We now have 10 point-to-point wireless links running ethernet from the campus to outlying off-campus buildings where it is not practical to provide fiber connections. We are seriously considering adding a Metricom wireless network for use by end users.

Current Campus Connectivity Problems

Like most campuses, we have no wireless connectivity for portable computers, the dial-in telephone modems are overloaded, the open student computing labs are overloaded, and the computing budget and staff are decreasing.

Planned Solutions

The dial-in modem pool is being increased to 672, and its usage is being rationed. Part of the pool will allow only 30-minute connections, and the rest is unlimited. We are also planning to install a Metricom wireless network, to provide at least some assistance in relieving future overloads and provide better user service. It must be clearly understood that a wireless network is only a supplement to a good wired network; it cannot be used alone since it cannot have sufficient speed or capacity.

Why Metricom?

You could design and install your own wireless network, by purchasing wireless equipment from a number of vendors in the field. This could provide greater speed than what Metricom offers, but no University has fully done this as yet. The cost of such a network would be comparable to a wired network, both initially and ongoing. Metricom is alone today in providing a different alternative. They will install the entire network at no cost and then charge the end user for using it. This is a classical outsourcing situation.

What does the network look like?

Metricom installs antennas and radios on rooftops or streetlight poles throughout the campus and all surrounding university areas, such as fraternities, sororities, apartments, etc. Users buy or rent a small radio modem which functions exactly like a dial-in modem. No special software is required. The user may use any software which supports a PPP connection over a dial line. Any kind of user computer may be used. The wireless network functions transparently, allowing all usual Internet functions such as telnet, FTP, WWW etc.

Metricom Wireless Network Capabilities

About 30 kilobits/sec connection to campus wired network. We have measured this doing FTP between two portables, in a point-to-point mode.
Connects all portables anywhere on and near the campus.
Connects desktop computers in unwired dorms.
Connects desktop computers in off-campus housing areas.
Connects portables in and near your home.

If you live miles from the campus, you can do this with two radio modems in your home. One connects to your telephone, the other to your portable out on the patio.

Connects portables while traveling away from campus.

All Metricom campus networks throughout the country are connected together via Metricom's private Internet. Hence you can access your home campus while visiting any other site where a Metricom network is installed.

Connects computers via private networks. Any computers within radio range can communicate directly with one another, without using the campus wired network.

Costs

Metricom:
Installation, monitoring, maintenance, and expansion of the network as needed.
End-User support, via 800 number, Email and on-line BBS.

University:
Electrical outlets and electricity, connections to the wired campus network, and the staff time to work with Metricom in planning.

End-User:
$245 one-time and $20/month. Free Summer vacation. You own the radio.
OR
$45 one-time and $30/month. Free Summer vacation. You rent it.

Campus Computer Store:
Earns $45 commission on each sale.

For Further Information -

Many campuses are now installing Metricom networks. Some of the early ones are Stanford, Austin, UC Santa Cruz, Oregon, Oregon State, Miami, Indiana, Illinois, Clemson. There is a discussion list where current and prospective users compare notes, and the archives of all past comments are available. To subscribe, send email to:

listserver@lists.acs.ohio-state.edu
Leave the subject blank.
In the text, say ONLY this:
subscribe metricom yourfirstname yourlastname

You will then receive introductory information, instructions on retrieving past postings, and all future postings.

Merging of Voice, Video, and Data Over a Single Cabling Infrastructure

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A detailed description of the construction methodology to integrate into a single project the design, construction phase, and operations of a residence hall rewiring project. This project provides full 82 channel video capacity with educational and entertainment offerings, 10 base-T Ethernet connectivity to the desktop, Category 5 UPT cable, and RG-6 coaxial cable.

The combination of using multimode fiber in all building riser systems, horizontal Category 5 cable within 300 feet of any intermediate distribution closet, and single mode fiber for campus-wide distribution will be described and slides depicting the installation process will be provided.

The use of composite cable with an approved UL sheath reduced the labor costs on the overall project by one-third. The composite cable consists of two four pair Category 5 cables and one RG-6 coaxial cable terminated in a multiport jack.

The cable television portion of the project will be outlined including the use of a unique PC based addressable tap system used to control customer turn on and turn off as well as tier selection of program offerings.

Duke University is a private institution located in Durham, North Carolina, on approximately 8,000 acres of property with 6,000 undergraduate students, 3,500 graduate and professional students, and employs over 22,000 employees at the University and Medical Center. Duke University is a relatively new university being founded in 1925 through an endowment of the Duke family. Many of the buildings were constructed during that era which included most of the campus quad, residential areas, dining facilities, and the classroom buildings.

Duke University Tele/Video Department is charged with the responsibility of furnishing voice, video, and data connectivity to the campus and the Medical Center. We presently operate a AT&T #5ESS Central Office Switch with 18,800 lines in service. Included in the 18,800 lines are approximately 5,500 basic rate interface ISDN lines serving our academic and administrative areas.

In 1992 after much discussion and debate, it was decided that Duke should improve the intrabuilding wiring structure to upgrade its older and undersized copper wiring plant which carried voice and data over it. At that time, there was a modest cable television distribution system on campus utilizing a coaxial cable network distribution and RG-59 intrabuilding wiring into some commons areas of residence halls and a few administrative areas and meeting rooms. However, it was under funded and did not have a significant channel offering. The students of Duke University were very interested in increasing the availability of cable TV into the dormitory rooms and enhancing the entertainment channels available to them. It was through this interest and desire by the academic areas to enhance data connectivity, that the intrabuilding wiring project was launched in 1992.

There was extensive design work provided in developing an RFP to be sent out to various vendors to bid on the construction and operation of a CATV system. At the same time that the construction of the CATV system was to be undertaken, a category 5 copper cable plant enhancement was to be installed concurrently with RG-6 for cable TV and category 3 cable for telephony use. The bidders had some extreme concern with the various types of difficult construction that needed to be accomplished on the Duke campus which included older Gothic buildings as well as several asbestos laden frame buildings that needed to be wired. The results of the bids were inconclusive in that out of nine invited bidders only two chose to respond. One was at $6M and the other $3.8M to wire 3,400 rooms in the campus network. Duke Tele/Video estimated the work to cost $3.2M.

Duke University Tele/Video Communications decided that it would take on the project internally and act as a general contractor hiring electrical firms qualified in wiring the residence halls to proceed with the work. The other logistical problems beside the construction constraints were the logistics imposed by the use of the housing facilities almost on a twelve month basis. Special arrangements had to be made to coordinate with Housing available times that major work could be performed within the residence hall facilities. The Board of Trustees approved the project and permitted internal borrowing and the repayment schedule.

In the first summer of 1993, much of the work was done in unused residence halls and moved relatively smoothly. We were able to provide wiring for approximately 1,200 rooms the first summer. The whole project was estimated to cost $3.2M when done under the auspices of Duke University Tele/Video Communications. This included the actual purchase of wire, labor, closet construction, outlets, miscellaneous materials and the basic electronics for a 10 base-T Ethernet distribution system to each residence hall room. The basic equipment was provided by our Data Communications Department under another project, but it was only for building a single entry piece of data equipment and did not include intermediate and other data equipment requirements. The DukeNet project did, however, provide the fiber based connectivity to all of the residence halls and the cable.system was designed around a fiber distribution system with fiber transmitters serving eighty per cent of the construction locations. Also multimode fiber was pulled into the new closets on all floors of the residence halls so that no data outlet was more than 300 feet from fiber distribution or its associated electronics. As was mentioned, the total cost of the project through Tele/Video Communications was $3.2M and included the construction of complete CATV headend including a 160 foot tower and eight satellite dishes for programming reception.

The second year of construction accelerated the project and the headend was complete as well as an additional 1,500 rooms completed. Both in the summer and throughout the academic year we were able to make considerable arrangements with Housing to work over break periods and vacation slots and were to accelerate the project. In August of 1994 our new headend was complete and a 33 channel entertainment system was put into place. The students reacted enthusiastically to the availability of this enhanced programming. We were able to meet our projected sign-up rate to support the entire project fiscally for repayment. The $3.2M authorized by the Board of Trustees is to be repaid over a fifteen year amortization period, and we anticipated the first three years to be in a deficit position. The entire fiscal plan was built on a 40% sign-up rate at the $19.85 per room charge for entertainment and academic cable TV.

The first year sign-up was a very encouraging 55% of our entire residential student body at that level. There was desire on the part of many academics to provide "educational tier programming" that would be academic in nature and would be available to the majority of the student body both in the commons rooms, classrooms, and lobbies for viewing at a very low rate. It was decided that we would dedicate the first twelve channels on the system to this educational programming in order to provide for this need at a level of only $5.00 per month. This was subsequently dubbed our "EdNet" tier and our entertainment tier was appropriately named "DevilVision".

Because of this channel mix requirement, a simple way to provide this for people who wanted just the lower tier required the addition of an addressable tap system. We investigated several companies that provided an addressable tap system and found that most were geared towards a residential type system that you would find in a residential community. There was, however, one company that looked at an apartment type or residence hall type group housing and provided units that were designed for bulk addressable tap equipment. These were built-in units of eight, twelve, and sixteen which could be grouped together in larger residence hall closets in order to provide a true addressable tap system at the residence hall location. This addressable tap system would allow an operator from a standard PC located in the CATV office of Tele/Video Communications to initiate service from the PC over the carrier wire to the addressable tap and signal it through a series of digital commands. This would allow the operator to turn the signal on, turn the signal off, provide tiers of service whether it be EdNet, DevilVision, or our premium tiers which include such channels as HBO, Showtime, or Home Team Sports. This made the whole operation very efficient and provided very little truck roll or installation crew requirement to visit the residence halls to adjust for tier purchases or tier assignment. The additional cost of the addressable tap system will be quickly recovered within a two year period on savings of maintenance and truck roll. It was a very ingenious solution to a difficult requirement.

We decided to have two local originating channels from Duke Tele/Video inserted onto the system. We have a dedicated channel 5 which we have named the academic channel. We provide at no cost redistribution of the faculty members requested video tapes, specialized copyrighted material that has been cleared for redistribution and some live interviews on academic matters. In addition, we use it as a public service channel announcing Public Safety reports, use of emergency phones, computer hook-up instructions and specialized downlinks of an academic nature from time-to-time from around the country and the world. This has proved to be a very valuable information outlet for the University in general and is utilized continually.

Our second local channel is known as channel 31 and is our "movie channel". We have entered into separate contractual arrangements with movie suppliers to provide first run movies on this dedicated channel originating from the Tele/Video CATV office. In that office is a piece of equipment that is designed for multi tape playback and for graphic interaction on the screen with various graphics indicating time and date for the movie production. These are timed out and require little intervention on the part of the operator. There are twenty movies per month available on channel 31 and they are repeated throughout the month at various times throughout the day and evening so that the subscriber can see these movies at their convenience. It is proven to be very popular channels with the students, and we honor many of their requests for first line movies.

We were also fortunate during the construction of our satellite farm to receive a special grant from the Political Science Department authorizing us to construct a large 6 1/2 meter dish to bring in a direct feed from Moscow for the TV Network from Russia. This was a very difficult construction project since the Russian satellite being utilized is only eleven degrees above the horizon and has a definite wobble in its orbit. Therefore, the dish was mechanically constructed not only to lock on to the satellite with a laser pointer but it had to have additional motors installed so that the satellite dish could actually move with the wobbling of the Russian satellite. The quality of the picture is excellent considering those constraints. We distribute the Russian signal over our channel 43 for our students. This has proven very popular with our foreign language majors and visiting graduate Russian students and others who find the Russian programming to be very timely and appropriate.

We have also been traditionally involved with SCOLA, the foreign language broadcasting network which we have placed on our-educational tier and is again very popular with the foreign language majors and provides language broadcasts from numerous countries around the world. Our Russian satellite signal quality is of such value that we tape much of the Russian programming and send our tapes to McClellen, Iowa where the SCOLA network actually uses Duke University's tapes for much of their rebroadcast of the Russian network to their 3,500 world-wide downlink subscribers.

The construction of this total project was a difficult one, but we were very proud of the results. We have utilized a double gang outlet with two RJ-11 jacks, two RJ-45 jacks, and an RG-6 CATV outlet in each box located in each residence hall. There are some examples where there are single gang outlets in residence halls where there has been remodeling completed by the Housing Department and in two new residence halls constructed during the project. In those instances, each side of the room had their own single gang outlet with one RJ-11 jack, one RJ-45, and one CATV RG-6 outlet. However, the RG-6 outlets are grouped together at the intermediate closet location and has a single addressable tap unit. If students sign-up for CATV in the room they have two working outlets but only pay for one subscription.

We also had other difficult construction constraints in other locations in the University beside the Gothic architecture. We have a group of 515 apartments in a complex known as Central Campus Apartments which were built with Federal funds over thirty years previously. They were wired into the living room for telephony only and had no bedroom outlets of any kind. We made the decision to extend our standard wiring into each of the bedrooms as well as the living room and provide additional data, voice, and video connectivity in each of the bedrooms. Because of these extensive wiring requirements there were no interior building closet spaces available in any of these structures. A very unique design was utilized to provide this connectivity. In many cases, exterior wall chases were developed so that cable could be pulled up through an attic area and down through an exterior wall chase into a separate building structure that was air conditioned and housed the data equipment and CATV amplification equipment for several buildings. These structures had to be approved by an Architectural Design Committee on campus and were designed to resemble the Central Campus facilities and did not stand out against the other type of architecture in this particular area. It did require a great deal of trenching and a great deal of conduit pulls to provide the interconnectivity for the Central Campus Buildings. This was the most expensive part of the rewiring project but has proven to be a good decision in extending the number of outlets required into the bedroom areas.

The success of twiring project is very evident from the rapidly growing direct 10 Base-T Ethernet connectivity experienced in the residence halls. During the first year of availability of this type of connectivity only 550 students of the 1,200 outlets that were available took advantage of a direct connection to the fiber backbone and 10 Base-T Ethernet speed capability. However, this past academic year with the wiring complete with 3,400 rooms available for connectivity, over 2,200 students have been directly connected to the network. The others, of course, still have dial-up modem capability but we are encouraging them to directly connect to the backbone. Each incoming student is automatically given an e-mail address and is automatically included in the campus directory with their e-mail addresses provided on a campus-wide basis. The popularity of the use of their connections is obvious from the traffic patterns generated on our data network.

In addition, their phone service is on a voluntary basis and we have a 98.1% sign-up rate for all residence halls on campus. The direct connection to the Internet has not diminished the demand for telephone service, voice mail, or other services provided on the telephony side. The sign-up of CATV has also exceeded our projected goals with over 1,750 sign-up for the DevilVision tier this current semester including over 350 premium subscribers.

All of the subscribed services are provided under one merged Office of Information Technology. Our new Vice Provost for Information Technology, Betty Le Compagnon, arrived on campus on October, 1994, and was extremely anxious to merge and enhance the overlapping services provided various departments on campus. The reorganization has provided a mechanism to address all of the challenges of merging voice, video, and data together under one organization. It has proven to be very successful during the past year. She has taken on the additional initiative of presenting to the Board of Trustees in May, 1995, A $15M project to complete the rewiring effort in the residence halls and provide a similar project in the rest of the 167 academic and administrative buildings on the Duke University campus. This will be a four-year phased approach to the rewiring and we have initially begun the first year of the intrabuilding wiring project for the academic and administrative facilities. A similar wiring design is being utilized which includes 4 pair Category 5 both for voice and data, RG-6 coaxial cable and in some cases dark multi mode fiber to the desktop. This will be deployed in the School of Engineering which consists of three buildings which will have the standard wiring plan plus dark fiber pulled with the cable to the outlet in each engineering facility unterminated at the outlet and closet end. No electronics will be provided at this time. However, in the immediate future with the requirement for higher and higher speeds the dark fiber could be activated and the labor saved at this time will be realized at that time.

The Intrabuilding Academic Wiring Project will cover some 167 buildings when it is complete and will provide the 10 Base-T Ethernet connectivity presently used and will have capability of 100 megabit switched Ethernet and higher. Again, the general scheme is to develop closet spaces no more than 300 feet from any outlet and 300 feet from any electronic background equipment. The fiber optic ring is complete for the entire campus network and is operating well at the present time. We are moving up to FDDI capabilities on the ring as well as 10 Base-T Ethernet. It also supports some current 4 megabit token ring and 16 megabit token ring LANS which are slowly being phased into the Ethernet world.

When this massive project is complete, we hope to bring Duke University up to a general standard that is flexible, and can migrate to higher connectivity speeds as we move forward in the data world. It also provides video capability to most areas and provides a pathway so that any new technology that does develop such as ATM can be accommodated. For the future, our infrastructure will be in a position to migrate to these new technologies without the massive replacement and construction that we have had to endure during this project.

We also see the potential for wireless technology developing and do not discount the possibility that wireless can provide data connectivity on a very ubiquitous campus-wide basis. However, our investment in the infrastructure I have described will have a definite usage life of ten to fifteen years or more and provides the ability for higher speeds that are anticipated in the wireless world with continuing lowering of electronic costs for direct connection. The use of surface mount conduit and above ceiling open wiring troughs will allow us the flexibility to allow additional specialized cable that may develop as technology moves forward. We feel that at Duke University we have provided a plan of structure and action to bring Duke University into the 21st century of technology.

A Cooperative Approach to Document Imaging, Storage and Retrieval

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Abstract

The immediate objective of the St. Mary's University Document imaging project is to provide the Office of Financial Assistance with the ability to scan, store, index, retrieve, view and print the images of documents they receive.

The overall objective of this project is to provide this same ability to a number of departments within the University. Those departments would include, Admission, University Relations, Registrar, Academic Advising and the Comptroller's Office. We will integrate document images stored on the system within the University's administrative database system provided by CARS Information Systems. This will link them directly to the rest of the database information maintained on an individual or entity. This will also allow viewing of an image by any users connected to the University's Ethernet Network, provided we grant view privileges to that person.

We need to accomplish this with minimal financial and staff resources by working cooperatively with existing vendors to benefit all parties.

I. BACKGROUND

St. Mary's University is a comprehensive, private university in San Antonio, TX with an enrollment of approximately 4100 students.

Our Office of Financial Assistance processes Financial Aid application on approximately 3300 of those students each financial aid year. During a year the office will receive approximately 85,000 - 90,000 documents per year. These documents include things such as student and parent tax forms, financial aid transcripts from other institutions and financial aid verification forms.

Each year the financial aid office is spending $3500 -- $4000 dollars to have these documents microfilmed. In addition they keep approximately 350,000 to 400,000 hard copy documents in file folders stored within this office space.

II. PROBLEM

With limited physical space and the high demand for quick access to these documents the current manual filing system has become woefully inadequate to support the needs of the Financial Aid Office.

We needed to replace the current system with a technology solution in a short time frame and that fit into a limited budget.

III. APPROACH TO SOLUTION

We knew our solution would be to implement some form of on-line storage of the documents. The biggest drawback to this solution was being able to bring document imaging and storage on campus with the limited resources available.

I was sure that we did not want to bring in a totally new vendor into our current mix to handle this need. I have heard and read many horror stories about other institutions that have tried to effectively integrate document imaging systems into their existing networks and databases. In addition to the networking and software integration issues, We needed our document imaging solution to meet our work flow demands from a user interface point of view.

Our desire is to have an application that works the way our offices process the paper and to eliminate as may keystrokes and steps in the process as possible. The only solution to this was to leverage our long term relationship with our current administrative software supplier and work out an arrangement that was beneficial to both parties.

During the CAUSE94 conference I discuss this issue with our administrative software provider CARS Information Systems. We began exploring the possibility of a joint project to introduce document imaging into their product.

I was willing to commit a reasonable amount of our University's resources to the project. This project would produce the basis for a generic document imaging application that integrates with our existing software systems and will be used by all administrative operations with the need for document management. In addition to a limited monetary commitment the University would provide the necessary user input into the design and specifications for the application. We also would commitment to purchase the necessary equipment and to allow our vendor access to that equipment for development purposes.

The biggest hurdle to overcome at most institutions for this type of project is to secure the funds and authorization for this project from the University's Executive Council and the President.

The first step in this process was to work with our vendor and identify as close as possible what the costs would be for this project. Internally I began to meet with the Director of Financial Assistance and the VP of Enrollment Management to determine just what they could afford to do within current budgetary constraints. We also took this opportunity to reiterate that this project would have a long term benefit to all administrative operation within the University. This was a very important step in laying the ground work for project approval with the Executive Council.

Our discussions with the Director and VP helped identify the fact that they did have money set aside for the purchase of a new filing system and for micro filming of existing documents. We made the determination to redirect a portion of those funds to this project. The Administrative Computer System budget would be able to provide $10,000 from moneys ear-marked for special development projects that were still available.

Once we determined what the available resources were and established strong support for the project across the University, we worked in cooperation with our vendor to establish costs for the project. That cost including hardware, software and miscellaneous expenses came to $33,600 (see appendix A). The funding breakdown is a follows; $10,000 from the Administrative Computer Systems budget, $2,000 from the current Financial Aid micro filming budget and the balance of $21,600 from a pool of excess revenues over expenditures at the end of the fiscal year. This money was approved by the Executive Council after we presented the overall benefits of the project.

Our vendor was very open to this cooperative approach and understood our budgetary limitations. They also were receiving many inquiries from other clients about imaging application and therefore had reason to want work cooperatively with a client on the initial application.

IV. PROJECT OVERVIEW

The initial objective of the Document Imaging Project will be to provide the Office of Financial Assistance with the ability to scan, store, retrieve, view and print the images of documents received by that office. This capability will provide 3 main benefits to the Office of Financial Assistance.

1. **Saving of Space, the scanning and storage of document images electronically would eliminate the need to file and store the hard copy document within the small confines of the Office of Financial Assistance.**
2. **The ability to retrieve the documents of a particular student would be easy, fast, and available to multiple people simultaneously. Also we eliminate the time spent searching for misplaced or misfiled folders.**
3. **The ability to make backup documents and store the backup images at an off site facility. Most actual documents are not backed up because of the cost and amount of space required to store them.**

The overall objective of this project is to provide the ability of storing documents received by any department within the University. Those departments would include but not be limited to, Admission, University Relations, Registrar and the Comptrollers Office. We will integrate the document images stored on the system within the University's administrative database system, thereby linking them directly to the rest of the database information maintained on an individual or an entity. This would also allow viewing of any image by any users connected to the University's Ethernet Network provided we grant access to that person.

V. INITIAL DELIVERABLES:

The deliverables agreed to between St. Mary's and CARS Information Systems was to provide a system to handle the University's Office of Financial Assistance documents. This system will function in the following manner.

1. **As we receive documents, we collect them and take them to the scanning workstation. Here the operator will scan the documents and add indexing information via the workstation software.**

2. **We will return the documents to the person who will actually deal with them first. This person will retrieve the documents and verify image quality prior to the data from the document being entered into the system.**

3. **If the document later needed to be viewed or printed, then any user who has a networked PC connected to the CARS system will be able to call the document up and view or print it.**

VI. PREPARATION AND SETUP ISSUES:

The introduction of document imaging systems into the work environment requires those persons using the system to change the way the think about working with paper documents.

One of the most difficult concepts to get through to staff who will be utilizing the application is to resist the desire to print a hard copy of the document. A recent article in *Forbes ASAP* magazine raises the issues about how document imaging systems can actually increase the amount of paper used within an operation. In that article

> listen to Walter Jacobs, an engineer installing Lotus Notes groupware for James River's Pennington, Ala., production plant: "Human beings trust the printed word," Jacobs says, "that's something you'll never get away from."[4]

We found it necessary to work on changing these ingrain habits in order to achieve the maximum potential from an imaging system.

In introducing document imaging into an office you must work at changing the way in which staff work with information contained on these documents. Discussion about how documents will flow through the office are essential prior to the actual implementation of an imaging application.

We found that determining what is an acceptable quality of the document image is also an extremely important part for the setup and preparation of document imaging systems. This question relates directly to the issue having a cost effective imaging application. Although the cost of storage media is rapidly decreasing, the determination of what is an acceptable image to store weighs heavily on the amount of storage space you will require. A document scanned at 600 dpi will require six times the space as a document stored at 100 dpi.

Not only will the image cost more to store but it will alsocost more in terms of the time needed to actually scan, store, retrieve and print the document. You must weigh this carefully when trying to keep the cost of imaging to an acceptable level.

When preparing to implement an imaging application set aside time to identify the many documents that you will be scanning. By setting up tables that identify the size, number of pages and the image quality setting for each individual document, you will save time during the actual act of scanning the documents to be stored.

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VII. TOOLS AND TECHNOLOGY:

We are not purchasing a packaged imaging system, but instead we are having the application developed by our administrative software vendor. I thought it would be beneficial to describe the software and hardware that we will use in this application.

On the software side CARS Information Systems is using *Visual Basic* as the proto-typing tool. Eventually this will probably be replaced by *Visual C++*. *Integrated Business Applications Builder* is being used to develop the GUI front end and for data access. The actual imaging and scanning libraries are from *Data Techniques*, utilizing *Intersolv's Data Direct ODBC Drivers*, specifically for Informix 5. We should note that all development is being done with OLE compatibility in mind.

On the hardware and networking side our Financial Aid office is connected to the university's Ethernet network and operates on a local Novell server. All workstations are 486 DX2 66mhz PC's with 8mb of memory. They utilize Novell's Lan Workplace to connect to our UNIX based administrative system.

The scanning workstation is a Pentiuim 100mhz PC with a 1.2 gigabyte hard drive and 16 megabytes of RAM. This machine is running Window for Workgroups and contains a SCSI host adaptor. We have connected a HP Scanjet 3C scanner and HP Laserjet 4M Plus printer to the system. We also have purchased a HP 20XT Optical Jukebox drive that contains 16, 1.2 gigabyte optical disks that is used to store the images. This drive will initially be connect to our host HP 847 administrative system but may eventually be moved to the local Novell server.

One of the early issues that we needed to address when planning this project was where, and in what manner, to store the scanned images. Our initial thoughts were to store the images in a database BLOB field. Our investigation of this option uncovered some very valuable pieces of information. First, in order to store the images within the database we would have to purchase additional software from Informix our database software vendor.

This software, *Informix Optical* presented a number of problems for us. First it was moderately expensive at a price of about $4000.00. Second this software would only support Write Once Read Many (WORM) access to the optical disk drive even though the disk itself was rewritable. Lastly we learned that Informix has no current plans to support the writing to CD-ROM in the near future. This was very important to us for the future since this likely will be the least expensive storage option that we will have in the future.

As we looked at our options we decided that the better direction to take was to store the images on the optical jukebox under the UNIX file systems. We will include just the indexing and pointer information in our database. In addition to providing us more flexibility we also feel that this will serve to increase the access time to the images and reduce the impact on the performance of our database.

VII. ACTUAL COSTS INCURRED:

One of the major reasons that St. Mary's was able to move ahead with this imaging project was the relatively low investment that we needed to put into it initially. This combined with the gains in productivity that we expect to achieve from the project make us believe that we made a smart decision in pushing for the funding of the project.

The final initial startup costs broke down in the following manner and you can compare them to the initial estimates as outlined in Appendix A.

• Imaging Workstation Hardware	
Pentium 100MHZ PC 16mb RAM, SCSI Adaptor, 1 Gig Hard Drive	$ 3,026
HP Laserjet 4mplus	$ 1,812
HP Scanjet 3C Scanner	$ 943
Auto Document Feeder	$ 471
• Pentuim Fileserver for Financial Aid Office	$ 2,639
• Modem on Imaging Workstation for support	$ 87
• HP 20XT Optical Disk Drive w/16 optical Disks and HP-PB SCSI-2 host adaptor	$ 7,047
• CIS Software Development	$12,000
• Misc Software(ODBC Drivers, Informix Net)	$ 2,142
• Travel Expenses for Installation and Training	$ 1,500
TOTAL	$31,667

We have brought this project in under the anticipated budget but actually spent the money on different items than was initially anticipated. You must also keep in mind that our Financial aid office had 486 DX2 PC's on the essential staffs' desktops prior to this projects undertaking. Obviously this would have increased the cost for this application had we had to purchase the workstations needed for viewing the stored images.

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APPENDIX A

INITIAL HARDWARE AND SOFTWARE REQUIREMENTS AND BUDGET

The following outlines the Hardware and Software requirements for the initial phase of the Document Imaging Project. Outlined here are the minimum requirements.

• **Imaging Workstation to include (REQUIRED)**		**$ 7000**
1. Pentium PC, 90mhz, 16mb RAM, 1 GB hard drive, CD-ROM Drive, Network Card, 2mb Video, SCSI Card.	$ 3,500	
2. Mid range simplex scanner, monochrome, accommodates 8-12 documents per minute	$2,000	
3. HP Laser Jet 4M Printer.	$1,500	
• **Imaging Engine -- (REQUIRED) For initial trials the recommendation is to utilize a software engine. However, depending upon document flow and volume a hardware engine may be warranted, especially if a faster scanner is utilized. Note these hardware engines do not add any necessary functionality, just increase scanning speed.**		**N/A**
• **CARS Provided Software -- (REQUIRED) including the workstation imaging software and the add-ons to the CARS platform necessary to index the images in the database.**		**$ 12,000**
• **Miscellaneous Software Licenses -- (REQUIRED) for scanning workstation, software for printing from any station and operating system software.**		**$ 2,000**
• **Optical Disk Drive 20 GB HP Erasable Optical Jukebox Model 20XT (C1100A). One System provides ability to store 200,000 Documents on-line**		**$ 7,100**
• **Informix On-line Optical Software to allow access to the optical disk drive. This software require a $825 annual maintenance cost. On the HP E55 maintenance is $510 annually**		**$ 4,000**
• **Travel Expense for Training by CARS**		**$ 1,500**
TOTAL PROJECT COST		**$ 33,600**

FOOTNOTES AND REFERENCES

Footnotes:

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[1] Glen Rifkin, "The Future of the Document," Forbes ASAP, October 9, 1995, p. 44.

References:

Rifkin, Glen "The Future of the Document." Forbes ASAP, October 9, 1995, pp. 42-60.

Object Think: A Step Toward Object Oriented Implementation

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ABSTRACT

Have you been caught up in the idea of Object Orientation? How do you get the team members of that first project to start the transition to Object Orientation: How do you guide the team to think in terms of objects or to "Object Think"? This presentation will examine how DePaul University applied this learning process to the introduction of Object Orientation. Discussion will center around the process that was used in the introduction of Object Orientation and how the topic was introduced without the technical jargon.

PowerPoint presentation available,
see http://cause-www.colorado.edu/conference/cause95/c95track-5.html

Application Delivery in the '90's: A Framework for Change

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Abstract

The approval of a multi-million dollar, 5-year strategic plan for replacing most administrative information systems causes a university's information technology department to rapidly learn new technologies, methods, and business practices. In order to most effectively deliver new systems, the I.S. department re-engineers to a provide project-based matrix management, a framework for "build vs. buy" decisions, application assembly and intergration, and project support and improvement.

Background

During the 80's and early 90's, Stanford University implemented a set of integrated administrative systems that were written in SPIRES, a proprietary fourth generation language developed and supported by Stanford staff. All forms were put on line, electronic signature and routing were implemented, and on-line approval from electronic mail was integrated into the work flow.

By the end of the 80's as we were completing the last of our major administrative systems, we were already beginning to see the need for change. The very factors that contributed to the success of the administrative systems at Stanford were now creating a new set of issues. Since paper forms had been eliminated, the mainframe capacity needed to support the University's administrative needs was growing rapidly. Our reliance on proprietary systems made it difficult to find the skills we needed in the marketplace. In the highly competitive Bay Area, it is difficult to find technical staff who are willing to learn non-transferable languages and proprietary systems. Existing SPIRES expertise was diminishing as staff retired or pursued other career opportunities.

Technology was also changing very rapidly. What were viewed as "state of the art" systems when we started creating systems in the 80's were already being viewed as out of date by the time we were delivering the later systems in our applications portfolio. Distributed, client/server systems utilizing graphical user interfaces were starting to be available in the marketplace. And, according to the wisdom of the times, these systems could provide the same functionality as mainframe systems much more cheaply and in a much more user-friendly manner.

The "business" climate was also starting to change. What had appeared to be an era of unlimited growth was rapidly coming to an end. There was increasing downward pressure on all sources of unrestricted revenue: tuition costs , indirect cost recovery, and unrestricted gifts.

The changing financial environment led to decreased base funding for computing and systems support. At the same time, there was an increased need for flexible systems to provide timely information and to respond to an increasing rate of change in business requirements.

Added to these pressures for change, for Stanford University, probably the most significant push for new, more flexible systems came as a result of the government's indirect cost investigation of the early '90's.. One of the findings of the investigation related to the inadequacies of the existing financial systems. Although the on-line systems created in the 80's provided capability to view information in the general ledger, and to perform some financial transactions, the central general ledger system was created in the 60's and was difficult to extend, had outgrown the original schema for the chart of accounts, made it difficult to close the books at fiscal year end, and was updated only monthly, making timely financial reporting extremely difficult

In 1991, it was determined that our core financial systems should be replaced for the functional reasons stated above, and increasingly, also for technology reasons.

The Change Process Begins

The first step (needless to say) was to re-organize the information systems staff. To provide a critical mass of resources to implement new systems, and to leverage economies of scale, a new centralized applications group was formed. This unit was called Business Information Systems Applications (BISA), and reported to the Chief Financial Officer. During the summer of 1993, an Administrative Systems Strategic Planning effort was launched under to sponsorship of the Chief Financial Officer, and led by the University Auditor. An AIS Planning team was formed with membership from the schools, central administration, BISA, and other technology support units on campus.

At this time the scope of the planning effort was extended to all administrative systems on campus. Concurrent with the AIS strategic planning effort, several business process improvement and/or re-engineering efforts were launched. The primary goal of these efforts was to eliminate non-value added activities and thereby reduce both central administrative costs , and administrative costs in the schools and departments.

The AIS planning effort concluded in the summer of 1994. Twenty-two major systems initiatives were identified, and scheduled for completion over a five year period. The Board of Trustees approved the plan, and projects were launched in September of 1994.

From Chaos Comes Knowledge

Knowledge can be divided into four categories: 1) what you know you know, 2) what you know you don't know, 3) what you don't know that you know, and 4) what you don't know that you don't know. In September of 1994, the number of items in category 2 seemed to far outnumber those in category 1. Over the past year, several items that were in category 4 have now moved into category 2. Category 3 represents the 'nice surprise': when you discover you know something that you weren't aware that you knew or didn't recognize the value of.

Category One: What We Knew

- The Board of Trustees had approved a high level 5-year systems plan, which outlined the need for 22 new or replacement administrative systems.
- Since the financial systems form the foundation needed for many of the enterprise-wide systems used at Stanford, they were first in the place for replacement.
- Stanford wanted to re-engineer its business processes in conjunction with the delivery of new systems whenever possible to help maximize potential savings.
- Stanford had decided to look to the marketplace for new systems solutions. The ongoing and exit costs of proprietary software solutions were proving to be quite high. Our goal was and is to use vendor packages, industry standards and expertise.
- A new Information Technology Systems and Services organization was being formed to be led by a vice-presidential level Chief Information Officer.

- Our new systems would be open, standards-based, state of the art, distributed client/server (insert your favorite buzzword here)....

Category Two: What We Knew We Didn't Know

We knew we wanted to be client/server and distributed, but as an organization, we possessed little knowledge and experience in these newer technologies. We knew we needed to quickly gain and/or buy (contract for) expertise in:

- distributed computing
- relational data bases
- application development tools
- object technology
- new languages, including visual programming languages
- frameworks
- middle ware
- analysis and design methodologies
- project management processes, standards, and techniques

Since we knew we wanted to implement vendor provided and supported products whenever possible, including application packages, we knew we needed to find out more about vendors of client/server packages.

The category of what we know we don't know has grown significantly as we began the process of finding answers to our questions. That's how we know that items are moving from Category 4 (what we don't know we don't know) to Category 2(what we know we don't know). For example, we didn't know that we needed to understand maturity of client/server vendor solutions until we began to explore the package system marketplace.

Issues that we now understand need to be addressed and/or questions that need to be answered include:

- What is our target technical architecture? What is our strategy for achieving it? Current marketplace solutions often do not conform to the target environment.
- What criteria will we use to evaluate vendor packages? What is the decision making process?
- What industry standards do we want to adopt? There are many to choose from. Microsoft sets the de facto standards, just as IBM did for mainframes.
- What 'flavor' of client/server architecture is desirable: two-tier, three-tier, multi-tier?
- Just how open do we want/need our architecture to be?

Plug and play sounds great. Are we ready for the multi-vendor, multi-site license, version control headaches this approach brings, or can we make progress more quickly by purchasing application suites that provide proprietary solutions.

- What exactly is meant by integration in a client/server world anyway?
- What relational database vendor do we want to use? Can we afford to support more than one?
- How is security provided in a client/server world
- How object-oriented do we want to be?
- How do we measure system success? Is the goal efficiency and cost reduction? Or is the goal effectiveness and better service and support?
- How is a project-based organization different from a traditional, hierarchical organization?

In what is probably a common approach when there is so much work to be done, so many questions to be answered, and so many decisions to be made, we started everything at once.

Good News and Bad News

The good news about starting many efforts at once is that knowledge is quickly added to the "what we know we don't know" category. The bad news is that forward progress is quickly impeded by the large number of unknowns that must be dealt with. This can quickly lead to demoralization and "analysis paralysis" when it appears that so many decisions in so many areas need to be made at a time when there are so many unknowns in our industry.

In order to provide focus on the new systems work needing to be done, a separate organization was formed, Information Systems. Staff in the newly formed IS are not responsible for support of existing systems. Working with clients, they formed project teams to perform the detailed requirements gathering process needed to begin package evaluation and selection. As part of the AIS plan, it had been decided to look to the marketplace for system solutions and to limit the amount of custom development; however, we needed a framework for when to buy and when to build.

Although work could progress on functional requirements in the absence a defined technical architecture or a uniform process for vendor and package evaluation, we quickly determined that a defined systems delivery process for the new I.S. organization would streamline our work. In the autumn of 1994, an I.S. focus team was formed to examine concepts of component re-use and assembly, and to recommend an approach for delivery of new systems. The team identified several inhibitors that could lead to less functional, less integrated systems than our current legacy systems. The team made the following recommendations:

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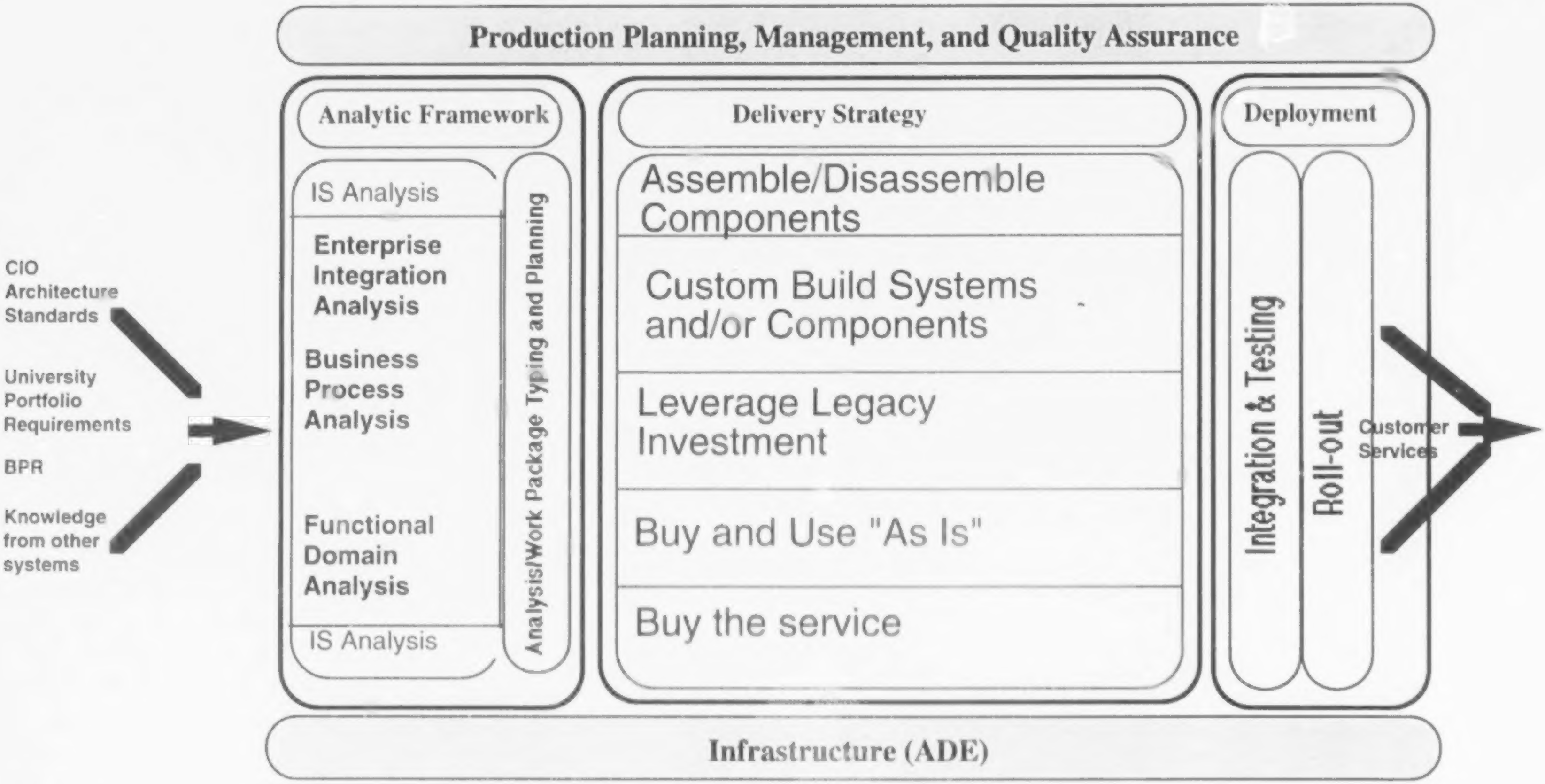
"The Software Shop" an I.S. Business Model



Production Planning, Management, and Quality Assurance

CIO Architecture Standards

University Portfolio Requirements

BPR

Knowledge from other systems

Analytic Framework

IS Analysis

Enterprise Integration Analysis

Business Process Analysis

Functional Domain Analysis

IS Analysis

Analysis/Work Package Typing and Planning

Delivery Strategy

Assemble/Disassemble Components

Custom Build Systems and/or Components

Leverage Legacy Investment

Buy and Use "As Is"

Buy the service

Deployment

Integration & Testing

Roll-out

Customer Services

Infrastructure (ADE)

(figure 1)

BEST COPY AVAILABLE

- A new process for system delivery that would include:
  - portfolio and functional domain analysis
  - enterprise data and process views
  - alignment of the delivery solution with the value of the business process
  - componentizing of applications

- A new method for identifying reusable components:
  - functional and process domain analysis to meet the needs of the central administrative offices (functional view) and the schools and departments (processes such as 'establishing a new course' that go across many functions)
  - intersections identify potential areas for reusable components
  - frequently used functions, for example: cut a check, within a functional domain are also candidates for re-use

- A new process for determining value
  - priority processes support identity process such as teaching and research
    - drivers are increased market share
    - often differentiate a "business" from its competitors
    - customized system solutions are often required
  - background processes are business processes, such as purchasing, that are needed by any business
    - drivers are low cost and efficiency
    - package solutions usually meet all requirements
  - mandatory processes, such as those required by environmental health and safety, are those required by outside agencies
    - package solutions will meet common requirements, like compliance with tax laws via a payroll system

The team created a process model for I.S. that we called the Software Shop. (figure 1). Like any process, the Software Shop has inputs and outputs. The inputs are: architecture, standards, business process redesign, and knowledge from other systems. The output is a new application. The process is supported by an application delivery environment (ADE) infrastructure, and is managed via planning, quality assurance procedures and organizational direction and oversight.

The Software Shop process has three components: analytic framework, delivery strategy, and deployment. The analytic framework requires three kinds of analysis. Enterprise integration analysis determines how the proposed system interfaces with others. The data and process models for the new system are integrated into existing enterprise data and process models and both are modified as needed. Areas of potential overlap or missing functionality are noted. Business process analysis maps a business process from beginning to end and notes the need for information or process logic that may be provided by other systems. Functional domain analysis identifies common procedures within a functional domain (such as financial systems) that can be re-used by many applications.

The delivery strategy is based upon whether or not the system is a priority system or a background system. Most administrative systems support background and mandatory processes. There are five delivery strategies. These strategies are not mutually exclusive, but represent mix and match approaches that will probably be used in varying proportions for the delivery of all new systems. The first approach is: buy the service. This suggests that no systems are installed at Stanford to support this business process. Both the business process (or function) and the systems that support that function are outsourced. An example of this might be a lab store. The store would be run by an independent business and that business would be responsible for keeping it stocked appropriately, and for providing any computer systems it needed to do so.

The second strategy is to buy a package and use it 'as is'. This strategy implies that the business practices may need to change to fit the package. A third strategy is to leverage our investment in legacy systems. Stanford has created excellent authority, routing and work flow applications. Potentially these systems can be 'componentized' or 'wrapped' so that newer systems can make use of their functionality. The remaining two strategies would be used primarily for priority systems. These strategies call for building systems and components and assembling them to create new applications.

The deployment component of the Software Shop model begins with the integration of system components, and testing of the resulting application. This new system is then rolled out for general use and turned over to the application support organization.

The I.S. Software Shop recommendations were completed in early 1995, and the I.S. organization was subsequently re-organized around the concepts in the model. The I.S. organization was structured into six units: Application Project Integration (API) was formed for the analytic framework process; Application Assembly and Integration (AAI) was formed to deliver and deploy applications; the Projects and Planning Office was formed to introduce and support standard project management methods and quality assurance practices; the Application Support Center (ASC) was formed to provide and support the application delivery environment; and Application Resources (AR) was formed to support the acquisition of staff for the projects. The sixth unit, Data Administration, was already in existence.

Parallel Efforts

While the I.S. organization was being defined and formed, many projects had already begun. Each team was defining its own processes and approaches, and making its own assumptions regarding technology, package usage, vendor selections, use of object technology, etc. Outside the I.S. organization, infrastructure projects were being prioritized, and a project management and system development methodology was being chosen.

As might be anticipated, the result of these uncoordinated and sometimes conflicting activities led to organizational confusion. In addition, the sheer magnitude of work to be done often resulted in communication breakdown. There was a general lack of understanding of the new I.S. organizational structure, both within I.S., and among our clients and other parts of our parent organization, ITSS. The lines of authority between and among line managers and project managers were not clear. Project managers were accustomed to having line manager responsibilities. Line managers found themselves largely in support roles, with little or no staff.

At the same time, the University senior management team (RASOG, restructuring and administrative systems oversight group) charged with overseeing both business process redesign initiatives and the new system initiatives began to realize that it needed to define a clearer decision making process, and to identify when it needed to be involved in review of the initiatives. As a result of the selection of the Navigator methodology from Ernst and Young which defines the roles and responsibilities of sponsors, executive sponsors, project managers, steering committees, and executive steering committees, RASOG began to realize that more and consistent structure and support was needed across all systems initiatives.

Where We Are Today

Several resignations among the management of the I.S. organization created the opportunity to re-examine our structure. The basic organizational unit is still the project. There is a high level of acceptance of project structures recommended by Ernst and Young's Navigator methodology which calls for involved and committed project sponsorship, full time project managers and project team members, and project steering committees. The I.S. organization has been reconfigured and now has only 3 line units: data administration, project support and improvement, and architecture and infrastructure services. In order to keep infrastructure projects aligned with application projects, we are forming steering committees for infrastructure projects that include project managers of the application system initiatives. We've come to realize that the sheer magnitude of the work to be done is far too great for existing staff to accomplish in the time required. We are now in the process of 'pre-qualifying' vendors as technical partners.

A change support team is being formed which will provide support to the multiple change initiatives, especially supporting the entire University community in the areas of training and job redesign and many new systems and procedures are introduced across campus. reporting to executive steering committee. The change support team will also be responsible for high-level coordination of the initiatives in order to help manage the level and rate of change being introduced during any one period of time. The team will define and implement consistent communication to the campus.

Several related projects are being integrated into a core financials program. This will help to keep these projects aligned and coordinated. An integrated package suite will be chosen to support the core financials, and will help provide, by default, an applications architecture, infrastructure and language that can be built upon as needed. This decision will move more items into category 1: the things we know.

Lessons Learned

1. The senior management of the information technology (in our case, the direct reports to the Chief Information Officer) need to agree on technical direction and approach.

   Differences of opinion in areas such as build vs. buy, whether or not to embrace object technology, and methodologies make it difficult for the project teams to proceed.

2. There needs to be general understanding, acceptance and buy-in of new organizational approaches.

   The project managers in the I.S. organization did not understand the functions and purpose of the line units. This led to resentment, lack of trust, and a disassociation with the organization itself. Projects became self-contained units with little or no management or oversight from I.S.

3. Line managers must have expertise in their areas of responsibility.

   This would seem to be self evident, but when it is overlooked or ignored for whatever reason, the entire organization suffers.

4. Don't use inexperienced contractors in key management roles.

   The position of Manager of Application Assembly and Integration was outsourced, since it was felt that no one at Stanford had experience in component creation and assembly. Having a contractor in a management position created many problems. These were compounded by the fact that the contractor selected for the position was an unseasoned manager.

5. The culture of the organization needs to be used to introduce change.

   Stanford, like many Universities, has a very consensus-based culture. This fact was largely ignored when establishing the new I.S. organizational structure. Without taking the time to get understanding and buy-in, the new approach was never accepted, and in some instances, was actually fought.

6. Line managers must understand their primary role is to support project managers and project teams.

7. Don't turn process into structure

   To be successful, projects will use the analytic framework, delivery and deployment strategies outlined in the Software Shop. The attempt to turn system delivery processes that teams should follow into an organizational structure was not a good idea.

8. First you plan

   Stanford jumped immediately into starting projects, largely because the Strategic plan had a start date of September 1994. We now realize our job would be easier today if we had taken the time to plan to the next level of detail, identified an optimal sequencing of application and infrastructure projects, selected application delivery tools, production data bases and platforms.

   Steps to include in a planning effort include the following:

   - Define a long term technical direction and strategy
   - Identify impacted systems and business processes
   - Define an architectural approach
   - Determine infrastructure, middle ware, and the common business services (modules) needed by enterprise-wide applications
   - Map dependencies
   - Create a tactical plan

9. Change takes time

   Implementing systems and the associated analysis and planning effort takes time. Acceptance of new structures and approaches takes time, consistent messages, and patience.

10. There are no silver bullets

Enterprise-wide client/server systems have much to offer; however, there is some step back in functionality from highly integrated mainframe environment. Processes taken for granted on the mainframe, such as authentication, version control, work flow, routing and email integration are just starting to appear in client/server systems.

Required flexibility and ease of change require closer attention to architecting systems in a standard manner, building (or if possible componentizing packages into) smaller single or few function modules with standard published API's

Be prepared to implement short team solutions that can be replaced; concepts are ahead of the marketplace.

The Nice Surprises

Remember the third category of knowledge: what you don't know you know. During the past year, we've had some pleasant occasions when we realized that we knew more than we thought we did. Mainframe knowledge is transferable. Screens may be called the presentation layer and be GUI, but they are still used for the same purpose. Business logic is still business logic and data is still data. The processes used for gathering requirements still work. Data models are still quite useful. Project Management skills are still very important. Every once in awhile the old adage is true: the more things change, the more they stay the same.

5-8-1

Multimedia and Asynchronous Learning: Changing the Role of Academic Computing

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Abstract

The traditional paradigms for teaching and learning follow the Socratic model which is not only time and place dependent but predominantly uses linear teaching tools such as the lecture and textbook. The changing nature of the workforce and the increasing demand for higher education to reach students off campus requires us to look at new paradigms for teaching and learning. After decades of promises based on overhead projectors, classroom video, teaching machines, and other instructional technologies, the ability to improve instruction by integrating digital technologies across the curriculum has become a reality. By incorporating digital text, audio, graphics, animation, and full motion video into the lecture, laboratory, self-study, interpersonal and intergroup communication activities that are fundamental to teaching and learning, the quality of both increases. To effect these changes the nature of Academic Computing Units will need to transform itself if it is to support these emerging technologies and cultural changes.

Introduction

After decades of promises based on overhead projectors, classroom video, teaching machines, and other instructional technologies, the ability to improve instruction by integrating digital technologies across the curriculum has now become a reality. By incorporating digital text, audio, graphics, animation, and full motion video, into the lecture, laboratory, self-study, interpersonal, and intergroup communication activities that are fundamental to teaching and learning, the quality of both increases.

A paradigm shift is taking place in instruction, from a mode of faculty-student interaction taking place in specified locations (campus classrooms) at specified times (class schedules or office hours) to one in which students have access to most of the information content in a variety of forms at their convenience (when the choose, and where they choose from a variety of locations, including their living quarters). This shift is possible because several technologies have matured that provide the basis for major changes in the delivery of instruction. Education in the future must support both synchronous and asynchronous interaction between the learner and the sources of knowledge and information. Real-time, simultaneous two-way video presentations, multimedia presentations, and "education on demand" can be delivered to students on the campus, in their homes or their work places. Connectivity to the Internet and World Wide Web allows students and faculty to access educational resources anywhere in the world to supplement these aforementioned services.

Escalating costs, declining financial support, increasing demand, and diverse demographics have placed significant pressures on higher education to become more productive. Careful analysis shows that the productivity improvements required cannot be achieved by increasing the workload of the faculty; in fact, any significant movement in this direction will only decrease the quality of instruction. There is simply no room left in the workday of a faculty member to teach more students. Rather, the focus for productivity improvement must be on learning.

It is this realization that is leading to a paradigm shift where students gain access to information resources, faculty lectures and demonstrations, conferencing and tutorials over networks from digital information organized in servers by the faculty. The productivity gains occur in both retention, more efficient use of the student's time, easy access to group studying over networks, better feedback to faculty, and organized self-assessment and self-pacing. Faculty and traditional classrooms are not replaced, but another dimension is added that greatly improves the efficiency of learning. As this new process of using technology to improve learning develops, more students will be able to take advantage of this type of instruction.

Virginia Commonwealth University (VCU) has been exploring several cost-effective teaching models and technology solutions which are designed to improve learning productivity, reduce labor intensity, provide new ways of delivering education and better services to students while improving the quality of instruction. If effective, these concepts could be integrated with and, expanded to, other programs and institutions.

Strategic Plans and Goals

Over the past two years VCU has embarked on a strategic planning effort to define the future role of information technology in support of the university's academic and administrative programs. The VCU Strategic Plan states that technology will be used to deliver traditional education to the University, the community, the Commonwealth, the nation and to the world.

The visions that emerged recognize that technology can benefit learning when it:

- allows a student to take a more active role
- allows a teacher to express the content of a course in more than one format
- effects students by using techniques that reach various learning styles
- broadens the array of resources brought to a classroom and the student's workstation
- increases the opportunities for interactions between teachers and students and among students
- increases the productivity of those who support the learning environment

Instructional computing in the next decade will be symbolized by communications between machines, office and office, classroom and library, teacher and student, the campus and the world (network connectivity) not by isolated desktop machines. The next revolution will be less about the technology of computation than about access to information and ways of sharing information. Consequently, this revolution will involve most members of the university communities not only those who have been traditional beneficiaries of technology.

In the new environment, every instructor or student working alone at their office desk or working with others in any campus classroom will access not only the powerful tools of the desktop computer, but also the networked applications and information resources of the University and the world beyond.

The plans envision high-bandwidth network connection to faculty offices and classrooms, network port distributed throughout the campus, high-bandwidth/telephone access from off-campus sites or residences, classrooms equipped with systems for displaying prepared lecture material and sharing information resources, on-line processing of grades and other student records, and desktop search and retrieval of a wide variety of library materials, including multimedia, international journals, databases, reference works, and scholarly discussion groups. Also they call for a new methodology for faculty to conduct and publish research, create and deliver lectures, and interact with students.

The speed and scope of change in instructional methods promised by the new technology is unprecedented in educational history and will require unequivocal institutional support not only to create the infrastructure to make this possible but also to meet the need for faculty motivation and training.

This plan calls for institutional policies to encourage individual faculty to make the required investment of time and effort, provide incentives for faculty development such as release time or direct pay to conduct and/or attend training, consider professional development in this area for retention, promotion and tenure purposes, and support faculty with well-defined projects for experimenting with new technologies and innovative ways of employing them in the teaching, learning, and research processes.

Achieving these goals will move these institutions toward becoming fully integrated "virtual universities" utilizing asynchronous learning networks in which students, faculty and staff are linked by electronic mail, two-way interactive video, on-line processing, electronic databases, library services, multimedia-on-demand, and other information technologies without regard to physical locations.

The potential benefits of moving in this direction include:

- enhanced quality of instruction
- access to information and library resources
- high levels of support services to existing students
- increased access to academic programs by non-traditional students
- improved effectiveness in uses of limited human, program and financial resources
- net revenue streams to offset infrastructure and operating costs
- incentives to faculty to develop new educational materials

Applications envisioned

This vision would support and enhance traditional instruction, non-traditional instruction and administrative processing. Typical applications could include:

Delivery of education to students in classrooms at multiple sites in the continental United States and internationally, e.g.:

- capturing unique faculty experts and special lecturers on video to augment lectures/courses
- downloading information from multiple sources into a multimedia presentation in the classroom
- teaching low enrollment courses at multiple campuses using two-way video and electronic teleconferencing and collaboration software
- evaluating student teachers remotely in the classroom and communicating via electronic mail
- teaching remediation courses at senior universities remotely from community colleges
- conducting library/text searches on-line world-wide
- requesting assistance via electronic mail with timely responses from faculty
- interaction between students or students and faculty utilizing bulletin board or conferencing software

Delivery of education to non-traditional, off-campus students in their workplaces or homes, e.g.:

- specialized training and retraining programs for industry
- professional licensing/certification courses
- adult education/enrichment programs
- continuing education or degree credit programs
- advanced placement courses to high school students

Implementation Plans

Electronic Campus and Digital Library
VCU is rapidly becoming an "electronic campus," providing access to all major resources through a ubiquitous network. This fiberoptic network connects all buildings and residence halls on both the academic and medical campuses, and will link to a "Digital

Library" to support the concept of a "virtual university" and asynchronous learning networks, as shown in Figure 1. The "Digital Library", Figure 2, will provide faculty and

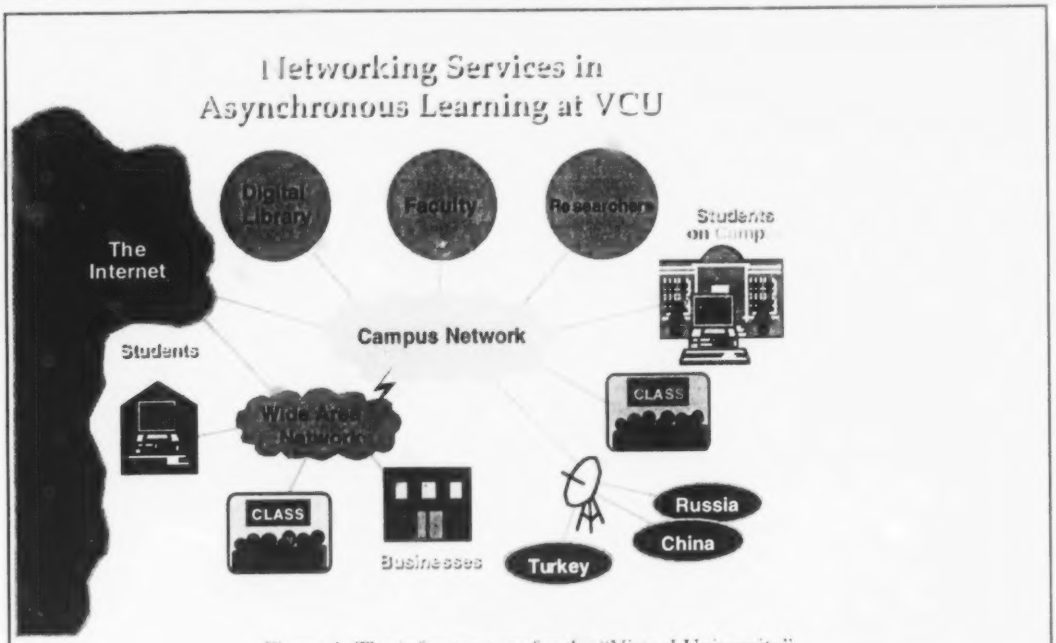
Networking Services in
Asynchronous Learning at VCU
Digital Library
Faculty
Researchers
Students on Campus
The Internet
Campus Network
Students
Wide Area Network
CLASS
CLASS
Businesses
Russia
China
Turkey

Figure 1. The infrastructure for the "Virtual University"

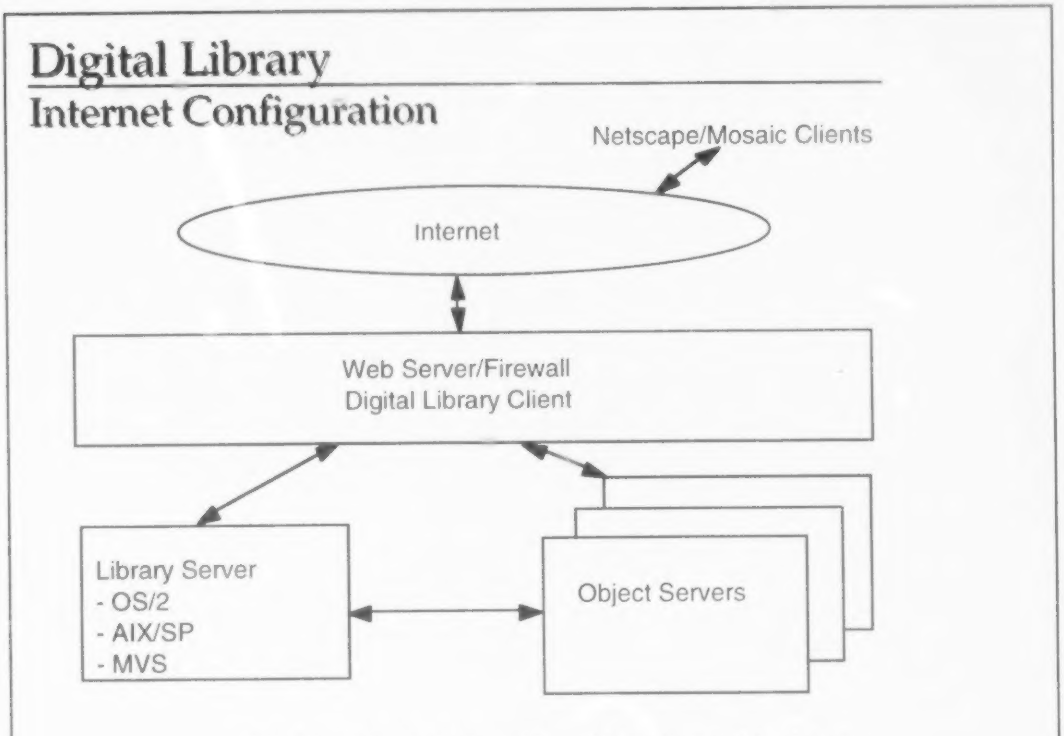
Digital Library
Internet Configuration
Netscape/Mosaic Clients
Internet
Web Server/Firewall
Digital Library Client
Library Server
- OS/2
- AIX/SP
- MVS
Object Servers

Figure 2. The Digital Library will provide students and faculty an integrated networked environment.

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students with on-and off-campus access to a full range of information technology resources (voice, data, video) in an integrated, networked educational environment. It also will facilitate local and statewide access to full-text articles and publications, electronic library services, databases, multimedia presentations, a central repository of CD-ROM materials, interactive television, and a wide variety of other material including slides, graphics, and video. It will also serve as an important node in a client-server topology supporting campus-wide services and functions in a multi-level server architecture, Figure 3.

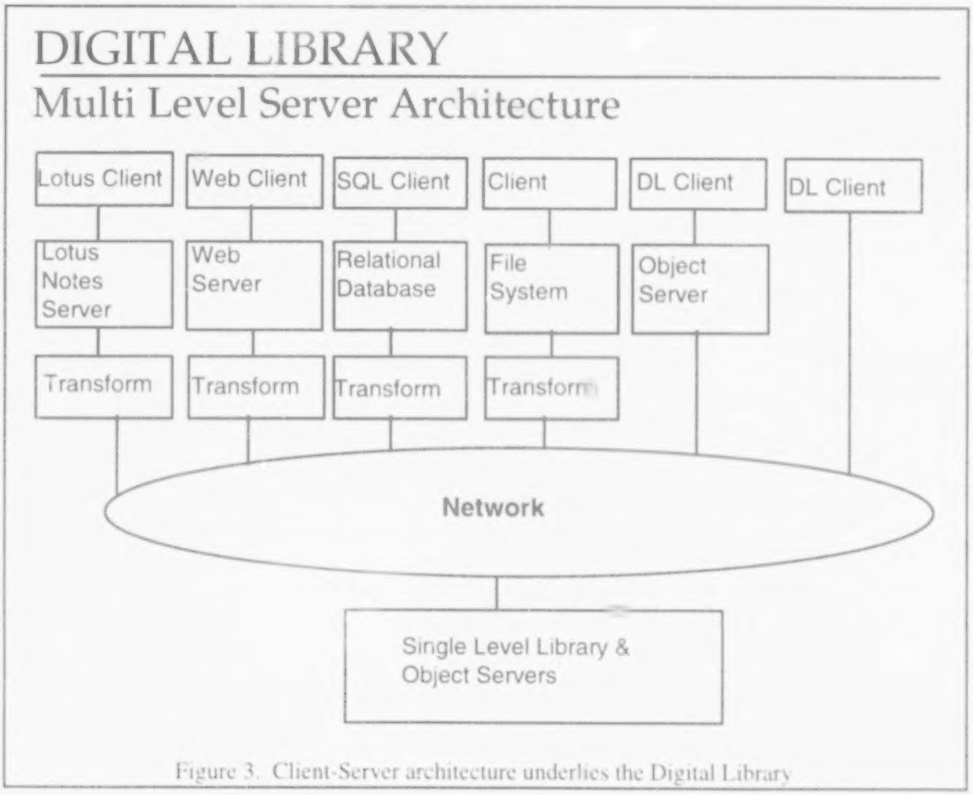
DIGITAL LIBRARY
Multi Level Server Architecture
Lotus Client
Web Client
SQL Client
Client
DL Client
DL Client
Lotus Notes Server
Web Server
Relational Database
File System
Object Server
Transform
Transform
Transform
Transform
Network
Single Level Library & Object Servers

Figure 3. Client-Server architecture underlies the Digital Library

Authoring Workstation
VCU is equipped with both IBM and Apple authoring workstations and software tools, including image editors (PhotoShop), video editors (Premiere, D-Vision) and authoring packages (Persuasion, PowerPoint, ToolBook, Authorware, Hypercard, Action and Director). Other resources available to faculty include scanners and digitizing stations to convert source material from work process, VHS tape, laserdisc, CD-ROM, illustrations and artwork, full video production facilities including a video taping studio, hand-help video cameras for off-site work, digital, video and sound editing studios, and in-house support for creating VHS tapes and CD-ROMs.

Electronic Classrooms
VCU is committed to developing "electronic classrooms" equipped with high-resolution projectors, quality audio, microcomputers with high-speed network access, and presentation software. Faculty will be able to bring their own presentation control software to the classroom, connect to a local or remote server, and access a wide variety of digitized

materials to enhance a classroom lecture under their individual control. This concept is illustrated in Figure 4. VCU now has several classrooms equipped with large-screen video projection systems, Macintosh and IBM-compatible computers or interfaces, and network connections. Although delivery of full-motion video is limited at present, several programs (e.g., the School of Pharmacy and the Department of Physics) are developing content which requires the delivery of full motion streamed video.

Electronic Classrooms

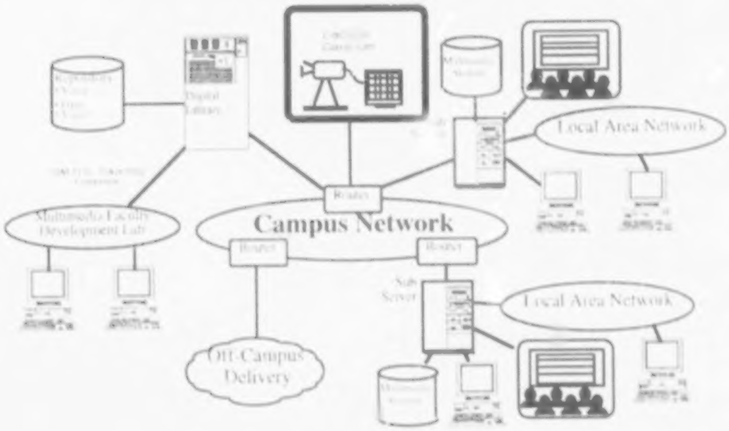

Figure 4. The Electronic Classroom provides a mechanism for delivery of content and a facility to access content from the Digital Library and other network resources.

Virtual Classrooms

VCU is developing the capacity to "digitize" lectures which can be edited, indexed and stored along with course materials. Both the lectures and materials can be retrieved later to supplement existing classroom instruction, either as stand alone video, or more likely integrated with interactive multimedia presentations. A system for interactively is being developed to encourage conferencing and interaction between the faculty and students participating in this "Virtual University". Initially, this will be accomplished through electronic mail, bulletin boards and newsgroups, or software such as *Lotus Notes*. Today with these tools students and faculty can communicate electronically whenever they like. Assignments can be given and received electronically. Faculty can hold "virtual" office hours, freeing them from rigid schedules, and enabling students to obtain information with little loss of time. Although the method for student/faculty interaction will change, these technologies should allow the quality of interaction be maintained, or, in the case of the large lecture, improved over current levels.

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The Role of Academic Computing

Prior to 1980 the role of an academic computer unit was typically to operate a mainframe and provide software consulting support for the users of these large, timesharing machines. When the personal computer revolution began, academic computing centers invariably took the lead in offering all levels of support: consulting, training, even repair. A decade later, personal computers became ubiquitous and support moved from a centralized model (where academic computing units supported the PCs), to a decentralized one (where departments now provide for basic PC support). The primary reason for this is that personal computers are no longer new and the knowledge to support them can be readily found.

The example of personal computing represents a fairly well-established process of migration of support. In other words, when the technology is no longer new or rare or exotic, the role of the academic computing center transitions to the support of emerging technologies (e.g., World Wide Web and client/server technologies) while the support structure for mainstream technologies (e.g. PC support) migrate to the academic and administrative units. For this reason academic computing units today have made a major commitment to supporting and disseminating information about networks, the Internet, the World Wide Web, and multimedia education.

At VCU the changing role of academic computing support has manifested itself in many ways:

Multimedia Development

A new faculty support unit has been created to provide the leadership for the creation of a student-centered and asynchronous learning environment at VCU. This new unit provides not only the consulting expertise to assist faculty in the development of their own skills, but has expertise in instructional design, applications development, network implementation, media digitization and editing, and systems programming to create a successful educational module. The role of this unit is to facilitate development of multimedia applications in the distance, distributed and asynchronous educational field. At VCU the Multimedia Development Center works to change the way that faculty look at the traditional teaching and learning paradigm; and to use asynchronous products to promote teaching and learning outside of the traditional classroom.

Faculty Support

The role that Academic Computing units play in faculty support must also change. In the past the training has been primarily given in brief training sessions of one to three hours, and has been a scatter-gun approach which has not reached the mainstream faculty. VCU is now developing a major effort to provide 40 hours of intense hands-on training for each faculty member in all the newest technologies of multimedia and asynchronous learning. During these workshops the faculty will begin to create content that can be accessed over the University's data network, the Internet and World Wide Web. The faculty member will come away from this training ready to take an active role in planning and implementing changes in the way he/she teaches.

The Cyber-Consultant

The traditional role of consultants in Academic Computing units has been to provide one-on-one, face-to-face consulting. As the faculty home base moves away from the mortar and bricks of a campus, and as students become less willing to be campus and classroom bound, the consultant will need to learn how to provide consulting information without ever seeing the person face-to-face. In fact, the consultant will use the same tools that are being developed for teaching and learning at the "Virtual University". They will need to practice what they preach, and by using these tools become more accessible to faculty and student alike.

Access to the Ubiquitous Network

Providing full Internet access is a major support issue which has already emerged. VCU has decided to outsource this function to a private Internet provider. The infrastructure to create this function for 2,000 faculty, 5,000 staff and 20,000 students is prohibitively expensive in today's changing market. In fact, it is likely that the entire infrastructure will need to be changed in two years. Today's 28.8 kb modem over analog dial up may be today's technology choice, but ISDN is likely to replace it in the next several years as the need for higher and higher bandwidth to the desktop are dictated by the emerging technologies of the World Wide Web and the Digital Library (e.g., full motion video and high resolution imaging).

The role of academic computing support has changed because the level of access to information has become so pervasive. In a brief twenty years, Academic Computing units have moved from supporting a few mainframe users with terminals on campus to supporting students and educators world wide who demand better service from their office, home, or residence hall, and even from foreign lands.

Conclusion

Technological advances to deliver education-on-demand are progressing rapidly. VCU plans to take this technology and apply it to education in order to overcome the economic, cultural, and physical barriers to learning facing the United States and the world. This includes continuous retraining of the workforce.

The current economic restructuring plans causing "downsizing" combined with unprecedented growth in demand for higher education will require universities to mirror business and industry by delivering "just-in-time" rather that "just-in-case" education, and to pursue cooperative efforts with the private sector to achieve this vision.

Virginia Commonwealth University will not achieve these goals all at once. We intend to proceed deliberately, with a careful eye on changes in technology that may change the goals, and on vicissitudes in the economy that enable them to implement the new pedagogical paradigm. Still, universities must begin proceeding now toward an asynchronous learning network environment and a new faculty support structure if they are to deliver the sort of education the students will need and demand as we move into the next century.

CAUSE
95
New Orleans
Nov. 28 - Dec. 1

TRACK 6
NETWORKING AND TELECOMMUNICATIONS
Coordinator: Gilbert Dionne

Looking to the Year 2000:
Alternatives in Campus Data Networking

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Abstract: At CAUSE94, a University of Pennsylvania presentation, "Designing and Implementing a Network Architecture Before It Becomes Obsolete," focused on the methodology for designing a network architecture on a decentralized, diverse campus. This presentation focuses more specifically on the emerging vision of the University's campus data communications network, and a set of structured architectural alternatives under consideration. Using the World Wide Web remains the primary vehicle for disseminating information about plans and assumptions to the campus and the world.

The authors acknowledge the assistance and long-standing collaboration of Penn colleague, Ira Winston, in the development of this paper and the concepts underlying it. A more detailed (and evolving) version of this paper, including links to the CAUSE94 paper, is available on the World Wide Web at URL, [`http://pobox.upenn.edu/~danu/cause95.html`].

Many commentators have dubbed 1995 as "the year of the Internet." Studies point to exponential growth in networks and individuals connected, Web sites and other resources accessible, traffic carried on institutional and wide-area backbones, stock prices of Internet-related companies, number of Internet (paper) millionaires, and articles about the Internet phenomenon. Less discussed, but more critical, is an understanding of strategies for accommodating (or at least coping) with this exponential growth.

At the University of Pennsylvania during the fall semester, we have been busy coping with such insurmountable opportunities as:

- Unveiling of a secure Netscape front-end to mainframe-based student record and student financial services data. Students were delighted with the new access to their records, until we withdrew the service after the "secure" Netscape encryption algorithm was cracked by two Berkeley students.

- Roll out of a new, graphical front-end to unify traditional network services by Penn's Wharton School, which dramatically increased demand

- Swamping of the central Help Desk, with the heaviest load coming from students off-campus struggling with PPP installation and configuration on Intel platforms

- Architecting a higher-bandwidth Internet gateway in cooperation with PREPnet, our regional provider

- Criticism from some students that we withheld support for Windows95, which had been released days before the start of the semester. The daily paper headline read, "University scorns Windows95"

- Upgrading overloaded campus news server and modem pools

- Queries from faculty on leave, such as, "telnet response is slow from California; what's wrong with your network?"

- Queries from staff, such as, "The Provost needs to be enabled for MOO access in order to participate in the English Department's real-time poetry discussions

Penn is not alone, of course, in facing the consequences of the growth in demand for Internet access and network support. In fact, 40 university representatives meeting in Keystone, Colorado in October reached consensus on six key network strategy issues that require attention on all our campuses (and, ideally, efforts toward cooperative solutions). These issues are:

- Remote access. Anytime, anywhere access sounds great, but modem pools are costly and inadequate for multimedia. What about ISDN, CATV, wireless, outsourcing?

- Capacity. What will the growth curve look like as Pentium and PowerPC workstations are deployed widely, GUI Web browsers proliferate, and desktop audio and video mature?

- Technical infrastructure. What roles for Ethernet, fast Ethernet, FDDI, ATM?

- Security. No one is satisfied with reusable, plain-text passwords, and amateur systems administrators can't keep pace with professional crackers.

- Network management. We all need better monitoring, diagnosis, and trouble ticketing systems.

- Financing. Price performance is improving, but not keeping pace with demand. Full-costing, marginal costing, and "library models" all have advocates -- and problems.

All six of these issues are on the agenda of Penn's Network Architecture Task Force. This paper focuses on the technical infrastructure domain.

Abut the University of Pennsylvania

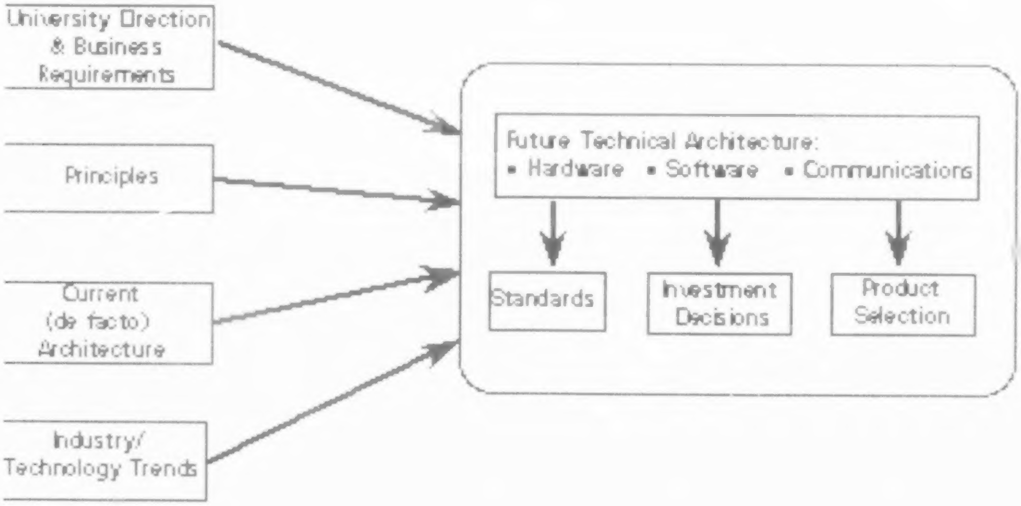
Penn is a private, research university founded in Philadelphia in 1740. Enrollment numbers 22,000, with 10,000 undergraduates in four schools and 12,000 graduate and professional students in twelve schools. Roughly 7,000 students live in campus residences; nearly all others live in walking distance. The University shares a compact, attractive campus with a 7,500-bed teaching hospital, large clinical practices in medicine, dental medicine, and veterinary medicine, and has an annual operating budget of $1.9 billion. The 23,000 staff and faculty reside in a three-state region (Pennsylvania, New Jersey, and Delaware); comparably few are within walking distance.

As one of the originators of responsibility center management, Penn has promoted autonomy, investment, and expertise in Schools and other units. Accordingly, all academic computing is managed outside the central unit, Information Systems and Computing. ISC is responsible for most core University administrative systems development and operations, data administration, a central help function, and data and video networks. (Voice services report to a different Vice President; Hospital IS, data, video, and voice services are separate.)

The Network Architecture Task Force

As detailed at CAUSE94, a Network Architecture Task Force was charged in spring 1994 to assess the current state of data, voice, and video networking at Penn, and to make recommendations for changes to these architectures during a three- to five-year planning cycle. Of the ten members of the NATF, the majority are drawn from outside ISC, including the director of Telecommunications, the director of library systems, and the director of computing in the School of Engineering and Applied Science, who serves as co-chair.

The NATF methodology, derived from work of Project Cornerstone, Penn's aggressive initiative to re-engineer business processes and deploy modern, client-server administrative systems (described at CAUSE93 and CAUSE94), is depicted below.


University Direction & Business Requirements
Principles
Current (de facto) Architecture
Industry/ Technology Trends
Future Technical Architecture:
• Hardware • Software • Communications
Standards
Investment Decisions
Product Selection

The Technical Architecture is a blueprint for how future technology acquisitions and deployment will take place. It consists of standards, investment decisions, and product selections for hardware, software and communications. The Technical Architecture is developed first and foremost based on university direction and business requirements. Additionally, principles are used rigorously to be sure the Technical Architecture is consistent with Penn's information technology beliefs. The current (de facto) technical architecture is taken into consideration, as well as relevant industry and technology trends.

For the discussion that follows, readers will find it useful to have access to detailed diagrams of current and alternative architectures. These diagrams are available on the Web at URL, [http://nextb.dccs.upenn.edu/techarch/natf/].

Three Basic Architectures

Three basic architectural alternatives have been defined along a continuum from least aggressive to most aggressive with respect to the reliability, performance, and functionality they enable. These three basic alternatives represent a migration path that can be followed one to the other if Penn chooses. As markets and products develop, Penn may skip one or more alternatives in the "pipeline," or implement other variations that develop.

It is important to understand that not all elements of these architectures are different. Common elements include the following:.

- Internet connections: Eliminating our reliance on SMDS for connection to the Internet, FDDI is used to allow a scaled connection up to T-3 speed via PrepNet or another access provider.
- Inter-campus connections: SMDS appears more appropriate for scalable connections to remote sites within our metropolitan (e.g., New Bolton Center, Center for Judaic Studies), replacing dedicated T-1 service. HUPnet is connected via a routed connection scaling from 10 Mb/sec as necessary.
- Remote access: The analog modem pool continues to scale to meet demand, shifting to a combination of analog 28.8 bps, and digital ISDN lines (capable of supporting multiple protocols). Commercial access providers may supplement these pools especially for outlying areas.
- Advanced networks: Penn will provide coordinating support for advanced networking initiatives that may run counter to our conventional deployments. This will likely include swifter adoption of ATM and direct Internet or vBNS connections for certain projects.
- Treatment of legacy network environments: The ISN asynchronous network is eliminated early in 1996; asynchronous terminal server connections are completely replaced by Ethernet early in 1997. No new investments are made in 10-base-2 wire or electronics, and users are transitioned as buildings are renovated and rewired.

Miscellaneous elements:

- Network infrastructure servers are consolidated onto fewer platforms with better redundancy
- AppleTalk and IPX are routed campus-wide and access is provided for remote users
- Desktop hardware and software standards continue to evolve, as Windows 95 use surges
- PennNames, a system for creating a campus-wide unique user name space, transitions to feed a DCE secure core, and client/server services (including network access) transition to Kerberos.

Alternative A: Pervasive Ethernet Switches/Selective 100 Mb

Alternative A is the closest to PennNet's current condition. It preserves our current investment in the technology and operations of a central routing core, installs Ethernet switches in all buildings, continues EIA/TIA 568 as the wiring standard, but only increases speeds within and between buildings to greater than 10 Mb/sec on a case by case basis.

Major features include:

- Inter-building backbone: Collapsed backbone interconnected via FDDI remains, though with fewer, more powerful routers.
- Intra-building backbone: Buildings are connected to the backbone via Ethernet, or 100+ Mb/sec technology (FDDI or fast Ethernet) where necessary for increased bandwidth. Ethernet or fast Ethernet switches deployed in all buildings reduce the size of the collision domain within buildings and provide a scalable building interconnection.
- Wiring strategies and standards: EIA/TIA 568 continues to be the wiring standard. Ethernet switches are deployed within closets if necessary, though shared Ethernets within buildings dominate. Secure hubs prevent promiscuous listening on shared segments. Some 100-Base-X fast Ethernet outlets are deployed. Campus Ethernet connections migrate towards "personal Ethernet" to allow local hubs on 10-base-T or fast Ethernet outlets.

Alternative B: Fully Switched Core

This alternative presents a transition point between Alternative A and Alternative C. The only changes are in the central routing core ("Inter-building backbone"). Rather than a collapsed backbone of routers, the central hub now uses an ATM switch coupled to a "super router" to route between the subnets. A series of smaller routing switches, still located in a central core, start to share a distributed routing load. While management and operations continue to benefit from a single, consolidated location for this equipment, Penn moves one step closer to being able to distribute its routing load to multiple locations when necessary. The nature of the routers and switches at the center are now changing substantially, both in terms of cost and the relative functionality of each object (switching versus routing).

Since ATM switching is now a feature, some direct ATM connections are made possible into the production network either to support advanced projects now in production or servers that require the added bandwidth.

Alternative C: Pervasive ATM

This alternative represents where the Task Force believes Penn should be in 3-5 years. This is mostly dependent on the necessary investment level, but even more important on the development of products and standards in the marketplace to make deployment of or migration to this alternative possible.

Major features include:

- Inter-building backbone: Redundant central hubs, with automatic failover protection, use ATM switching between buildings coupled with a "super router" to route between subnets. An ATM "mesh" is established with some buildings serving as regional "hubs" redundantly interconnected.
- Intra-building backbone: Ethernet switches, eventually with ATM and/or distributed routing support ("edge routing devices"), are deployed everywhere to reduce the size of the collision domain within buildings and provide a scalable building interconnection.
- Wiring strategies and standards: EIA/TIA 568 continues to be the wiring standard. Ethernet switches are deployed within buildings as bandwidth requirements demand. Secure hubs prevent promiscuous listening on the few shared Ethernet segments that remain. Some 100-Base-X fast Ethernet outlets are deployed. Campus Ethernet connections begin to migrate towards "personal Ethernet" which allows local hubs on 10-base-T or fast Ethernet outlets. Limited deployment of ATM to the desktop

Three Additional Variations

Three additional architectural alternatives recognize that the marketplace may not develop in the directions we expect, and/or Penn may need to improve the performance of PennNet in advance of the availability of components to build Alternative C.

Alternative A': Pervasive 100+ Mb Backbone

In most respects this alternative is identical to Alternative A, except that in this case there is the need for all buildings to be connected to the campus backbone using a 100+ Mb/sec technology. To accommodate this bandwidth to every building, the campus backbone needs to change: the collapsed backbone is now interconnected via ATM switch to increase capacity at the core. Subnets are connected to central routers via shared or dedicated connections using 100+ Mb/sec technology.

Alternative AB': Distributed Routing with 100+ Mb Backbone

If the availability of the products needed to implement Alternative C becomes more distant, this alternative may provide some necessary solutions. It provides for a regionalized campus with several clusters of buildings connected together via 100+ Mb/sec technology, and fully distributed routing to each building.

Major features include:

- Inter-building backbone: FDDI switch deployed to handle multiple FDDI rings (or other 100+ Mb/sec technology) required in this architecture. Central routing is only for outside or inter-campus connections.
- Intra-building backbone: Clusters of buildings are connected to the backbone via 100+ Mb/sec technology (FDDI or fast Ethernet) for increased bandwidth. Ethernet or fast Ethernet switches deployed in all buildings reduce the size of the collision domain and provide a scalable building interconnection.

Alternative B': Selective ATM

This alternative allows the campus to migrate more slowly to ATM for inter-building connections.

Major features include:

- Inter-building backbone: Central hub starts to migrate to ATM switch coupled with a "super router" to route between subnets. Routing switches at the core start to distribute routing load. Some routers stay on old FDDI backbone providing connections for some buildings. Some direct ATM connections to core permitted as routing switches begin to migrate to buildings.
- Intra-building backbone: Buildings are connected to the backbone via 10 Mb/sec or 100+ Mb/sec technology (FDDI or fast Ethernet) for increased bandwidth. Some buildings are connected to the backbone directly via ATM and have edge routers installed. Ethernet or fast Ethernet switches deployed in all buildings reduce the size of the collision domain and provide a scalable building interconnection.

Network Alternative Pro's and Con's

Alt.	*Pro's*	*Con's*
A	• easy to implement today • less expensive	• perpetuates use of today's technologies
B	• starts down the road to distributed routing • may reduce per port costs of central routers • may increase overall bandwidth of the routing core	• significantly newer technologies in routing core that use proprietary protocols for distributed routing • depending on timing, ATM may still be too immature
C	• probably where we want to be ...	• can't buy it today • presumes a lot about market directions
A'	• will increase bandwidth to buildings today	• very expensive • perpetuates use of today's technologies
AB'	• will increase bandwidth to buildings today	• very expensive • perpetuates use of today's technologies • introduces additional operations issues as routing devices are distributed
B'	• allows for slower migration to ATM	• multiple generations of backbone technology difficult (and expensive) to operate and maintain

Next steps

The University's department of Data Communications and Computing Services (DCCS), in conjunction with the Network Architecture Task Force, is currently processing the above information and carrying out the following tasks:

- Accelerating legacy phase outs, notably ISN and terminal-server asynchronous services, closet electronics that are not remotely manageable, and obsolescent server architectures
- Pricing the alternatives
- Narrowing the set
- Engaging the campus stakeholders
- Interim deployment of Ethernet switches and other technologies
- Structured consultations with current and prospective vendor partners
- Constant re-assessment, including consultation with university colleagues

In addition, discussions are underway to
- Extend the Penn Video Network, now serving 50 buildings, including 16 residences, to other buildings on-campus and off
- Assess extension of the Bell Atlantic Centrex contracts for the University and Hospital versus purchase of one or two switches
- Determine the likely time frame by which ATM can function as the ultimate, voice-data-video integrator

Conclusions

Designing and deploying a cost-effective, high-performance, campus-wide networking infrastructure is extremely challenging, given the rapid pace of technological change, user demand, and vendor reshuffling. At Penn, the challenge is multiplied by our decentralized management, budgeting, and academic computing structures. It is becoming increasingly clear to most stakeholders, however, that in networking, we must, as our founder Ben Franklin exorted, "hang together, or we will most assuredly hang separately." The productive collaboration exemplified by the Network Architecture Task Force bodes well for Penn's networking future.

A more detailed (and evolving) version of this paper, including graphics and links to the CAUSE94 paper, is available on the World Wide Web at URL, [`http://pobox.upenn.edu/~danu/cause95.html`].

Repackaging and Recycling: Using Information Technology to Enhance Education in the Present and the Future

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This presentation will describe a project in which MLS students repackaged the information presented in a conference on Libraries in International Development using the Internet, video, and CD ROM technologies. Students gained practical experience, melded theory with practice, and produced tangible products to show prospective employers. Faculty gained experience in teaching using new technologies. We believe that the education of the future will be exemplified by this blend of learning, doing, reflecting, and creating products to enhance the educational experience of others.

Context

A fundamental change is taking place in the way we teach, how we deliver content, how we interact with students, and how we manage innovative educational programs. The relentless pace of globalization and technological innovation are accelerating the rate of change and will impact higher education even more in the decades ahead. Educational change is proceeding at variable rates on university campuses, driven primarily by the speed of adoption of information technology, faculty willingness to experiment with technologies, and the positive stance of administrative leadership. Additional factors include changing educational needs of students, nation-wide and global student customers, underlying economies of scale and an ever increasing competition for new students. Information technology enables universities to capture the economies of scale by going state-wide, national, and global. Smart universities rely on technological innovation to increase their market share. Technology is therefore driven by, and a key driver of, the educational market place.

As a school, the School of Library and Information Management at Emporia State University embodies the view of education described above. The following phrases illustrate how we would describe ourselves:

people first
using technology as a tool
customizing services
entrepreneurial
cutting edge
risk taking
valuing nimbleness
valuing diversity
valuing interconnectedness
repackage/recycle/reuse
multiple delivery methods for student learning
global in vision and curriculum

Striving to make the above values a part of our curriculum and our delivery of the curriculum, we prepare MLS students to repackage and customize information to meet the needs of a diverse clientele using appropriate technology such as the Internet, the World Wide Web, video production, CD ROM production, and more traditional database searching. Creativity, entrepreneurial spirit, and passion the topic of information transfer are admission criteria for our students. We offer an American Library Association and North Central Association accredited MLS on the Kansas campus and at distance sites in Denver, Colorado; Portland, Oregon; and Grand Forks, North Dakota. We have graduated students from distance sites in Lincoln, Nebraska; Albuquerque, New Mexico; and Sioux City, Iowa. We will start a new MLS cycle in Salt Lake City, Utah in June. Currently we have about 600 students enrolled in our MLS programs.

Philosophy of Education

Our philosophy of delivering our curriculum is to be responsive to the needs of working adults by providing classes in different formats. In our distance programs, students earn a degree in two years and eight months by attending weekend intensive classes offered about once every four weeks. These weekend intensives meet on Friday nights from 6:00 to 9:00, on Saturdays from 8:00 to 5:00, and on Sundays from 8:00 to 12:00. The face to face weekend intensive is supplemented by satellite, video, two way interactive classes offered via CODEC, Internet classes, home study classes, and classes in a mixed delivery format. Our goal is to be able to offer all our classes off-site and off-time in a variety of media to fit different learning styles.

This vision is consonant with that espoused by Carol Twigg in a recent article in the Educom Review calling for the creation of a national learning infrastructure. This national learning infrastructure is made possible by a variety of technology mediated learning environments "including stand-alone, computer assisted instruction (CAI) applications; networked information resources; experimentation via new modes of communication (e.g., computer conferencing); and distance learning developed by both individual institutions and consortial or statewide efforts and offered primarily, thought not exclusively, via television." This proposed national learning infrastructure would "simultaneously increase access (via the network, improve quality (through the availability of individualized, interactive learning materials), and contain costs (by reducing labor intensity in instruction"(1994:21). To her vision we would add the example of a school which is blurring the boundaries between theory and application, instruction and professional practice, and education and business.

The curriculum of the School is responsive to the idea of situated learning. We believe that a strong theory base in information transfer is necessary for preparing the information professional of the future. Our students therefore receive a thorough grounding in the appropriate theories of the psychology of information use, the sociology of information, information engineering, and management of information organizations. Then in a variety of tools courses and elective courses, they apply what they have learned in the theory courses. Recently the strength of this curriculum has received national attention. In the July/August 1995 issue of American Libraries, Ostler and Dahlin discuss the crisis in library education and end with a description of three entities who are enriching the theory and vision of library education. They describe our program in the following way.

> Emporia State University has developed a cogent new curriculum for library education at both the master's and doctoral levels.

The Project

One example of the application of our curricular philosophy to the repackaging of information is seen in the activities of a number of students and faculty last year. In May of 1995, the School of Library and Information Management hosted The Fifth Conference of Librarians in International Development which brought together one hundred twenty guests and twenty-six invited papers.

The conference was organized around the theme of "A Global Conversation about Information Transfer." Experts on the international information economy, information policy, information technology, as well as librarians who have worked on international information infrastructure projects discussed the implications of the emerging global information infrastructure. Four themes emerged:

1. New Geopolitical Order. The bi-polar world that began at the end of World War II has ended and change in the social, economic, and political order is evident to anyone who watches CNN. While it is not clear what these changes mean, it is apparent that the world is increasingly complex, dynamic and volatile.

2. New Technology. As information technology is embracing international standards, it integrates data, text, voice, and image information for delivery via networks. It is open and networked. Based on interconnectedness, it is modular and dynamic. Technology empowers knowledge professionals across the planet through real-time on-line identification and distribution of information and knowledge.

3. New Information Centers. The old storage oriented library does not work anymore. Instead a virtual, linked, global information-based organization streamlined for quality and productivity is called for.

4. New Information Environment. The stable, industrial-based system of limited competition is gone. It is being replaced with a dynamic, information-based system of unlimited competition. Markets, niche identification, and economies of scale determine the success of organizations. Old rules and ways of doing things are disappearing.

Universities as well as libraries are affected by the emergence of the new information environment. Educational markets have expanded beyond the traditional regional geographic boundaries and now serve national, as well as an international audience. Programs must be customized, timely, delivered wherever and whenever convenient to the learner.

We strongly believe in the message of the conference and in its timeliness. Part of our mission is to disseminate the content of the conference to an audience larger than that which was able to attend. Simultaneously we were able to provide our students with an educational opportunity which allowed them to apply their theoretical learning to practice and to create a product which repackaged and recycled current and timely knowledge.

Normally the knowledge created at a conference is captured at best through the publication of proceedings or may be disseminated in articles based on topics discussed. Later these ideas may also be diffused in classroom discussion. These modalities reflect the dynamics of a positivist, industrial world view regarding dissemination and its role in education. Much information gets lost.

For example, questions and answers following presentations are rarely captured for posterity. Nor is the opportunity of having experts on-site used to pursue ideas that they have presented. Most conferences continue with the old forms and procedures. Yet we have the technology in place to capture the details and nuances of a conference that enriches and adds value to the proceedings.

Modern electronic and digital information technology embody a new intellectual order reflecting the dynamics of non-linear, self organizing, self transcendent, and loosely coupled systems. Examples would include videos, CD-ROM's, listservs, and World Wide Web pages. Use of this technology can alter in fundamental ways the diffusion of ideas in classrooms.

To capitalize on this idea, the conference processes and interactions had to be captured within the context of new technology. Thus the entire conference was videotaped. In addition to the formal presentations, a wide variety of conference activities were documented. Examples include discussions among presenters, questions and answer sessions, as well as selected interviews with presenters.

The planning and organizing of the video documentation started six months before the conference occurred. A video production class was scheduled to begin in January continuing to its conclusion in the weeks immediately following the conference. This scheduling allowed the students to learn the philosophy and techniques of video documentation. The result was conference documentation by a trained production staff undertaking their third project rather than their first. High quality recording of video sequences with accompanying sound was thereby facilitated. Students benefitted greatly from this process: high level of skill acquisition, conceptual understanding of the process of production in relation to the theoretical whole, as well as a sample for their portfolio.

While undertaking the complex processes of pre-production, production, and post-production would normally be beyond the usual resources of a school, the fact that we had knowledgeable faculty in video production, students who had taken the aforementioned video production course, and technical support from our own Information Technology Lab helped reduce the complexity of such a project.

The Video and the Class

Once the conference in all of its variety and richness was captured on tape, the second phase of the project began. A number of students worked with faculty to edit the presentations of the keynote speakers into a series of videos. This was accomplished within six weeks of the end of the conference. These videos were then mailed to the group of students enrolled in the summer course on the Global Information Infrastructure. The students viewed the videos and discussed the issues they raised on a listserv expressly created for this purpose. Discussion was prompted by a question raised by the instructor. Then conversation was allowed to flow freely. Research by students was posted along with comments and critique by faculty.

Periodically the faculty printed out listserv messages covering a one to two week period. To facilitate content analysis printouts were assembled horizontally by time and vertically by subject. Themes were identified and correlated. The faculty members shared their analysis with listserv participants. Questions generated by the analysis instigated a rich process of value adding and dynamic scholarly discourse. Faculty analysis provided a key element in this digital discourse. The analysis provided the essential structure to what could have been merely a meandering conversation often exhibited in class discussion. Structure transforms information into knowledge.

This kind of teacher student interaction illustrates one way in which technology enhances and changes teaching. Class time is no longer spent delivering information since class participants viewed the video which captured the presentations of the conference key note speakers. Instead class time or listserv time is spent discussing ideas. Instead of the surface discussion which is the usual hallmark of face to face classes, students could view the video at their leisure. Then they could construct thoughtful responses to the discussion questions posed on the listserv. In the same thoughtful way, the faculty members could look at patterns which emerged in listserv discussion and shape and mold the discussion in a way different from the face to face classroom.

This kind of learning draws on what Walter Ong describes as "secondary orality." As Ong states, "This new orality has striking resemblances to the old in its participatory mystique, present moment, and even its use of formulas. . . . Secondary orality has generated a strong group sense, for listening to spoken words forms hearers into a group, a true audience, just as reading written or printed texts turns individuals in on themselves. But secondary orality generates a sense for groups immeasurably larger than those of primary oral culture, McLuhan's 'global village'" (1982:137).

The learning engendered by this combination of video and listserv class allows students the richness of multiple perspectives of a large class, access to world class thinkers on a timely topic, and the ability to assimilate the knowledge reflectively and craft responses to issues in their own time frame. By having to write their responses, they have had to draw on a deeper level of cognitive ability than an oral response calls for. Faculty also benefited from the experience of teaching in this new medium. The learning activities had to be reshaped and rethought.

The CD ROM

The next stage in the process is to involve a team of students in the creation of a CD ROM based on the original video of the conference activities. This activity is another example of the repackaging and customizing that is a vital part if the School's philosophy. The repackaging will draw on the theory of the visualization of information and on information engineering to make a new product available that is not bounded by linear constraints as is a video. Because CD ROMs will hold more information than a standard videotape, they will allow students to make more sophisticated choices in deciding how to make the information from the conference available to a user. As they log the information contained on the original video down to the sentence level, students will decide how to link ideas to make available the information in a hypertext format.

In ways not possible in real life or on video, students using the CD ROM will be able to juxtapose the ideas of different experts on the same topic and replay them at their own time. They will be able to view how the formal and informal conversations among conference participants amplified the discussion of the topic. They will be able to see the text of the speeches and hear them being spoken by the expert as they were originally delivered.

Thus the students involved in the CD ROM will be repackaging and recycling information and creating new knowledge in the way they making new combinations of information available. This kind of repackaging can continue for a number of semesters since a pool of video information has been created that can be used again and again as it is shaped for different audiences.

An initial evaluation of the success of the taping, video and CD ROM activities tells us that it is accomplishing the goals the faculty desire. It gives students an opportunity to apply their theoretical learning. It disseminates the content of a conference containing valuable information beyond what the usual life span. It allows a larger student audience to benefit from current information that can be accessed off site and off time. We are now looking forward to our next project. In 1997, the Sixth Conference of Librarians in International Development will be held at the University of Colorado at Boulder. A team of our students in the distance program in Denver will do the videotaping of the conference and have first choice of the activities of editing the video and creating the CD ROM.

This repackaging has a commercial application for the School also. Although we have done no marketing, people have begun to contact us and ask to buy copies of the video. We anticipate the CD ROM will have an equal or greater attraction for business people interested in the Global Information Infrastructure as well as for librarians and area studies faculty. As a faculty we have to decide how much effort we want to put into marketing and distributing these products. It looks like this is a project for the class in information brokering.

Conclusion

This new approach to curriculum design embodies the values and techniques of the global information economy. Some of these include seizing opportunities, sharing risks, allowing for multiple inputs and multiple outcomes. It also embodies the philosophy of the School to use technology as a tool to enhance learning. This cutting edge, entrepreneurial thrust will enable us to repackage/recycle/reuse information while giving our students the opportunity to apply what they have learned--hopefully becoming more marketable in today's competitive job market. We believe that this kind of experimental activity is the way higher education can remain viable in the 21st century.

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The Internet: Changing Relationships and Forging New Practices

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Abstract

The promise of the electronic age is one of making information accessible to people without time, place or format constraints. Today's technologies and applications pale in the face of the opportunities presented by tomorrow's high speed, commercial networks. Networks are restructuring our businesses and herald the inevitable transformation of higher education. This paper focuses on issues associated with the evolution of the way business works, drawing on influences of the restructuring of businesses on universities, and it suggests how remote access to university resources may transform the institution.

Transforming Our Organizations

Networks have changed the way business works. They have blurred the distinctions among suppliers, manufacturers, retailers, and distributors and closed the gap between the consumer and the company. Changing relationships are creating virtual companies where networks are an essential management resource. Whatever the business, the focus is on the customer connection. The customer-marketer dialog and interactive advertising over the Internet replaces the current mass-market advertising model with a one-to-one marketing paradigm aimed at achieving personalized service and flexibility that support excellent customer relations. [1]

Network communications capabilities have also changed the landscape of corporate research. Research teams are formed with the best scientists from different branches of the organization and often in collaboration with researchers from other companies--once considered competitors. The strategic use of global networks for collaboration is an important priority for American companies and sets the stage for shared discovery. Getting quality products from the lab to the market place in the shortest possible time and in the most cost effective manner is a major goal of corporate research. [2]

The success of businesses in streamlining their organizations and in using technology to become more responsive to a changing market-place has not gone unnoticed by institutions of higher education. Our cost-saving strategies are patterned after those of the corporate world and our long-range plans are peppered with such terms as downsizing, reengineering, total quality management, productivity, empowerment, outsourcing, and customers. Like the business environment, higher education strives to improve quality, contain costs, and increase access among its highest priorities. Restructuring higher education means reevaluating alternative delivery systems, curricula, organizational structures, technologies, and personnel. [3]

Downsizing and Restructuring

With declining sources of revenue and escalating costs, the price of a college education has outstripped many families' ability to pay. Universities and colleges have already begun downsizing their institutions, helped by early retirement programs, department mergers, communication technologies, and powerful software programs that shifted some of the workload from staff to faculty, thus reducing the need for certain types of secretarial services. Secretaries who could search, retrieve and catalog electronic information as well as handle managerial tasks became important assets to the department, others found their jobs eliminated.

Improvements in student administrative support services (admission processing, registration, financial aid, and billing) represent another area where transformation of business processes has led to better student services and reduced operating expenses. For example, when overall costs of college operations grew at a higher rate than inflation and revenues remained static, Babson College embarked on a major reengineering project. Its purpose, writes President William F. Glavin,

> is to reduce, streamline, and simplify the administrative operations of the institutions, freeing students, parents, employers, faculty, and staff from bureaucracy and paperwork so that they may devote more of their time and resources to learning and teaching. To this end, we envision a work place which focuses upon the delivery of high quality services to our customers through the efforts of cross-functional, self-directed teams, and responsive, easy-to-use, information systems, and technologies." [4]

While administrative services have used technology and better business practices to help reduce costs, there remains the need to find a less expensive way to deliver education. Technology, it is suggested, holds the key to this dilemma with the possibility of reaching and retaining a wider audience. However, technology represents a significant capital investment and requires a transformation of governance, assessment, and relationships with students.

Empowering Employees

In a networked environment, every level of the organization has access to more information than it can possibly digest. This makes the traditional hierarchical approach to information, where those at the top control the information while those at lower levels have limited access, no longer applicable. Today, people at the lower levels have access to external information that brings the competitive pressures facing higher education right to their desktops. In the business world, this result has led to a flatter organization with more opportunities to participate in the decision-making process. This trend has yet to appear in universities to any major extent, although there is evidence that electronic communication "reduces overall miscommunication, equalizing participation levels, weakens status systems, and emphasizes informational rather than normative influences." [5]

We need to pursue strategies that promote the successful practices of the Internet such as collaborative development of resources and services, direct participation in decision-making, and innovative ideas that spring from unexpected sources. [6] Information gaps among administrators, faculty, and staffs can be bridged if the electronic internal information-sharing structure also incorporates their insights. Frequent reviews of strategic plans are also important in that they keep in the forefront of our minds the future of the institution and our place in a market-based environment. Only a well-informed university community can recognize and respond to opportunities, unmet student needs, competitive information, and achieve the goals of a shared vision and mission for the campus. The right leadership can make it happen.

More than ever, students are everyone's concern. Their needs and objectives will influence the curriculum, the design of learning materials, and the delivery of instruction. If reengineering teaching and learning is about anything, it is about providing differentiated services to a diverse student body. [7] Information technologies make it possible to offer customized services with assistance from experts from different fields and in collaboration with other institutions and organizations.

Administrative Response to Change

Despite the fact that higher education has emulated business goals in administrative services and become more responsive to students' needs, colleges and universities have adopted instructional innovation very slowly. For example, one would expect that innovations designed to enhance instruction in large classes would be especially attractive to institutions with a high student-faculty ratio.

This is not the case, according to Siegfried, Getz, and Anderson [8] who found no "association between that ratio and any of the innovations aimed at teaching large classes more effectively, such as video projectors and wireless microphones." They reason that some colleges and universities are insulated from the competitive pressures that would force them to stay on the cutting edge in information technologies. For some institutions, differentiation in curriculum and proximity to the student's home town creates market power. But for those prestigious colleges and universities not driven to innovate more quickly, Siegfried et al. recommend that the governing boards need to explicitly encourage their institutions to be more progressive by identifying new practices to be adopted that the board can evaluate and then reward administrators for managing change successfully.

The resurgence of interest in undergraduate education on the part of university presidents offers some ground for optimism. The reality remains that faculty have not been promoted for infusing technology into the curriculum. Thus, faculty have generally shied away from the extensive time commitment required to become adept at using and managing new information technologies. The traditional criteria for promotion are still classroom teaching, research, and service with research generally given preeminence over the other two.

Administrators must work closely with faculty to find alternatives to the current instructional model and a means of controlling institutional expense and student costs.

Technology, by itself, cannot overcome bureaucratic disincentives. Success in integrating technology into the teaching process depends on early engagement of faculty in the planning process where training, support services, and recognition for their work in instructional technology are a part of the strategic plan.

With current competitive forces and the new educational alternatives available to students, universities can no longer refuse to invest in technology; they can only determine rate of implementation. A teaching infrastructure—linking computer, video and telecommunications technologies with the home, institution, and workplace—must be in place for instructional technology innovations to thrive. A flexible learning environment that focuses on the learner will depend on an infrastructure to facilitate technology-mediated learning.

Many universities have linked their classrooms, offices, and residence halls. Some have also included the local community in their network, and most would like to be able to extend their campus resources to distance learners wherever they may be. The argument is not whether one delivery system for teaching and learning should replace another. Rather, faculty should have the technological capability and be encouraged to experiment with technologies in their pursuit of the best mix for learning without compromising quality, and the institution should focus on making education available year-round—thus, reducing the time required to get a degree. These issues—an interactive infrastructure, a reward system, and a strategy for managing change—are some of the pressing issues that presidents must confront as they make choices about how scarce moneys are to be spent.

Collaboration and Distance Learning

New opportunities precipitated by advances in communications have brought universities and telecommunications companies together. In spring 1995, New York University offered a 16-credit graduate program entirely through an interactive network. NYU's collaborator, NYNEX, New York's main telecommunications company, linked each student's home to an NYU computer-base of instructional videos and group-communications servers through an Integrated Services Digital Network of high-speed telephone lines. Using the NYNEX ISDN service, NYU teleprogram students access video lessons on demand and participate in online computer laboratories as if they were in on-campus labs. According to Richard P. Vigilante, director of the Information Technologies Institute and founder of the Virtual College, online instruction provides busy adult students with a far richer learning experience than they would traditionally receive by just attending their evening classes. [9] Success with this delivery system will encourage promotion and expansion of other NYU courses aimed at students who want alternatives to classroom attendance and education-on-demand.

In addition to creating course materials for local use, some institutions are developing resource materials with an eye to sharing them internationally. The World Wide Web Server for Virology at the Institute for Molecular Virology, University of Wisconsin-Madison, was designed to disseminate virology-related information to scientists, students, and the general public. Included in the resources available are computer-generated images and animations of virus structures, topographical maps of virus surfaces, digitized electron micrographs, and much more. Not only is the server an important reference resource, but it can also be used as a forum for teaching.

Virologists are invited to participate in the bionet.virology USENET newsgroup and to share their course syllabi with new instructors. Being able to customized the virology server for use by their own students offers another exciting possibility. From the research perspective, it is simple to obtain structured data from a variety of sources and view animations of interactive visualizations of these data on their own computer. Researchers are encouraged to submit additional virus visualization to the virology server, thus, increasing its value to virologists throughout the world. "Ease of access to rendered structure data is expected to catalyze speculation and collaboration among virologist." [10] The uniqueness of this collection of resources is that it can serve both instructional and research purposes.

The "Making of America" is an ambitious collaborative project between Cornell University and the University of Michigan. Together, they are building a distributed digital library in the humanities—specifically 19th century U.S. history materials. Funded by the Mellon Foundation, the first phase of the project includes converting to digital image form 5,000 volumes from the holdings of the two library systems and making them available across the two campuses. As a part of the project, there are plans to conduct evaluation studies on user acceptance of digital surrogates and on the costs associated with the development. [11]

It is intended that this digital collection of books, articles, manuscripts, drawings, architectural blueprints, business records, maps, and other materials will include approximately 100,000 volumes in the next few years and will encompass a variety of disciplines bearing on the history of America. Project collaborators assume that "providing worldwide network access to such an electronically integrated collection of 19th century American history will open new opportunities for interdisciplinary research." [12] The project represents one of several "virtual" collections in specific fields which are being created and made available electronically, increasing the ability of students and faculty to share important historical resources.

Networks are the glue that hold collaborative projects together. They facilitate the cross-fertilization among disciplines and synergistic collaboration among the public and private sectors. Many of the projects currently underway are leading to the creation of significant teaching resources and research materials which can improve teaching and enhance research capabilities.

Approaching a Virtual Community

There is a shift away from schools as the central site for learning towards the home, businesses, libraries, museums, and other organizations. [13] Freeing students to learn at times and places of their own choosing requires new ways of thinking about the process of teaching and learning and the uses of university space and personnel. Distance learning presents a great opportunity to restructure educational methods to facilitate new delivery modes for a diverse population. However, many instructional television programs and Internet courses remain tied to traditional classroom and correspondence course metaphors, respectively. For the technology to succeed, it must have the underpinnings of an appropriate instructional model, and the faculty must have access to a full range of multimedia tools and support people to develop and implement new learning materials. Use of new technologies may likely be a participatory team effort bringing faculty, delivery personnel, and instructional designers together. [14]

Information technologies call for a new set of faculty-student relations. Faculty will move from lecturing to mentoring, giving more guidance to individual students and becoming active participants in the learning process, using a similar model to that of the graduate scientific research faculty and their students. In this teaching-learning interaction, students will shed passive note-taking for more immediate processing of information and problem solving. Classes will extend beyond the allotted time over the Internet. E-mail access to the faculty frees learners from the time and place constraints imposed by faculty office hours and gives students an opportunity to improve the quality and amount of communication with faculty. Students say that they form a closer relationship with their instructor and with other students through electronic mail and bulletin boards, that they get more timely and constructive feedback. There is a definite sense of community that evolves and a gradual transformation from passive learning to more self-directed learning.

Responding to Diversity and Distance Learners

One important contribution that information technologies can make is in addressing different cognitive styles. Some people learn best by reading, others by seeing, listening, teaching their peers, working in groups or some combination of these modes. Only a small percentage of the population are strictly auditory learners, yet this has been the predominant delivery mode. Furthermore, traditional pedagogy focuses on only two of seven human intelligences identified by Gardner:

the linguistic and logical-mathematical intelligences as reflected by intelligence test and other measures of ability.[15] (The other five intelligences are spatial, bodily-kinesthetic, musical, interpersonal intelligences, and intrapersonal intelligence.) Educational experiences that promote the various multiple intelligences and interlinkages need to be considered in the design of optimum electronic learning experiences.

Another important contribution would be the provision of just-in-time learning. The military, government, and industry have been successful in providing just-in-time training for problems that may arise on the job and must be solved before work can be continued on various projects. Expert systems help tank mechanics, power plant operators, income tax personnel, and a host of other workers learn on the job. Thinking about how people learn on the job is becoming an important research area. Designers are currently interpreting how people work and how the work gets done. This knowledge will be incorporated into tomorrow's powerful work systems and tools in an effort to support a productive business environment and have ramifications for higher education (see [16]).

Some faculty have also begun to apply simulations and smart tools as teaching-learning aids in their courses. Marie-Michèle Boulet [17] has developed an intelligent advisor system (Conceptual Database Modeling Advisor, CODAMA) for use in her two distance learning courses, "System Analysis" and "Design and Information Technology." The CODAMA, an adaptive system, assists distance learners in each of the several stages involved in database design. The system provides an on-demand learning environment which erases the boundary between learning and doing for distance learners.

The Choices We Make

Positioning Ourselves in Light of New Competition

The cost-effectiveness of communication also means that institutions of higher education can expect new competition. Britain's Open University recently delivered its first course on a CD-ROM. At universities around the world, technology is toppling the ivory towers. Approximately 4,000 corporate engineers currently "earn advanced degrees at their workplace via satellite from the National Technological University, now one of the largest engineering schools in the nation." [18]

Rochester Institute of Technology (RIT) offers graduate and undergraduate degrees including health systems administration, management, environmental management, applied computing, telecommunications, software development and management to students in 16 states. RIT recently has enrolled 150 high school students in a pilot program. Courses are designed to use a blend of four technologies: videotapes, conference calls, computers, and print material. Some courses are also supported by other technologies, including picture phones, electronic blackboards, or audio cassette tapes.

Another virtual institution with impressive enrollments is Maryland's College of the Air which specializes in part-time education for military personnel in Europe and Asia, using computer-conferences and voice-mail to allow students to communicate with instructors and with each other. The College offers 10 telecourses per semester via the Maryland Center for Public Broadcasting to approximately 10,000 students.

Competing with colleges and universities is a private company, Jones International Ltd., which operates cable television companies and Mind Extension University. Mind Extension University offers certificate and graduate degree programs in education, business, and library science. These graduate programs are delivered over the Jones Education Networks and are sponsored in cooperation with Colorado State University, the University of Arizona, and the George Washington University. In fall 1996, Jones International Ltd. is scheduled to launch two new networks: a Health Network and a Language Network—both are considered to be principal markets for distance learning.

International University College, also a creation of Jones International Ltd., is a recent newcomer to the growing list of competitors. It offers a Masters Degree in Business Communication and is billed as a low-cost alternative to traditional courses in higher education. Instructional materials for this degree program will be produced on videotape, and faculty members will use the telephone and electronic mail to correspond with students. The audience will be international and attract people not served by traditional colleges.

Internet courses are also fast breaking ground with over 30 accredited universities offering more than 650 courses over the Internet in 1995. Many of these offerings use the Internet primarily for its communications facilities. Nova Southeastern University, for example, grants M.S. and Ed.D. degrees using online technologies for communication and for discussion of the curriculum. Students have immediate access to electronic mail, bulletin boards, and formal, real-time electronic classroom sessions. Another example is Britain's Open University which plans to offer several courses and programs over the next year using the Internet as the communications medium between students, their tutors, and the university administration. Degrees offered will be the Masters in Open and Distance Education and the postgraduate computing courses which lead to an M.Sc. in Computing. In contrast, the Indiana University East and several other college programs use the Internet exclusively, registering students and providing all learning materials (tutorials, exercises, texts, and guides), assignments, and tests online.

However, it is likely that most institutions will continue to support teaching with a mix of media—some blend of networking technology combined with satellite, cable television, and CD-ROM—at least until speedier connections make transmitting multimedia over networks the norm.

Increasing the Value of Existing Resources

The Internet has significantly changed the way business is being conducted in the United States and abroad from marketing and selling products to the development of new products with customer participation. It has revolutionized the way business communicates by enabling them to put on-line marketing literature, product documentation, catalogs, and discussions about the performance of a specific product at other sites. In essence, the Internet is the world's largest store, the world's largest public library, the world's largest directly connected community, and the world's largest umbrella for public education.

The Internet is already changing the relationship between faculty and students and enhancing and facilitating student learning. Al Filreis, University of Pennsylvania, speaks often about some of the benefits of teaching his course on Modern American Poetry online. The silent ones in class, he says, found their voices online. Further, in reading each others statements, students became more aware of details and the consequence of their arguments and spent serious amounts of time thinking about poetry. [19]

Capitalizing on students' enthusiasm for web assignments, Daniel Anderson, an instructor in the Computer Writing and Research Laboratory at the University of Texas at Austin, created a web service for his American literature class. The American Literature Survey Site features fiction by American authors, papers, student reviews, and transcriptions of class discussions. A message board was added to allow Internet users to comment on students' essays. As the web site developed, individuals outside of the class began to respond. University students were surprised and motivated by the interest and comments of the outsiders, who one day just appeared. Other classes soon joined, allowing multiple perspectives about texts to take shape. Professor Anderson says it is a pretty amazing, new way of teaching.

One of the remarkable things, he notes, is the increased life expectancy and "membership" of the class. "The resources that the students developed are being made use of more now than even when the course was in session. Most students are still on the site listserv and receive feedback from all over the country. The site is showing the possibilities for students to interact with and impact an audience on a large and possibly long term scale." [20]

Many activities that impact on student learning are now available on the Internet. The examples given above demonstrate the value of online faculty-student interaction and intense small group discussions on specific topics. It is worth mentioning that students no longer lose touch with home town contacts and friends who are attending other schools. To this list, they continually add new people for mentoring and advising, encouragement, sharing experiences, and help with assignments. Some of these activities were once the responsibility of individual faculty to manage and are now available globally, 24 hours a day, 12 months a year from everyday people to experts in a particular field.

Up to now, faculty have typically spent very little time involved in what the literature cites is needed to assure quality: student-centeredness, attention to the teaching and learning process and gaining the feedback to assure educational effectiveness. However, when 25% of the freshman class drop out (most of whom leave for reasons other than lack of intellectual ability) and 55% do not graduate within four years, the institution needs to examine more closely its educational practices. The availability of the Internet, with its low-cost global communications, appropriateness for collaborative work, on-line software, and unique databases, gives us reasons to rethink the role of faculty and the use of technologies in order both to enhance student learning and reduce costs. In a networked society, we can expect that faculty will spend much more time locating or creating teaching materials and in organizing them into appropriate blocks of learning for a diverse student body. How will their restructured role change learning? One view is that:

> ...students will spend more time learning by themselves and with their peers and much more time engaged with powerful, interactive technologies, and will spend less actual time–but more creative, intensive, and focused time–with faculty members. Faculty, in turn, will work with greater numbers of students but "teach" much less [in the classroom]. [21]

Distance learning, as a supplement to existing university life, will play an increasingly larger role in providing greater opportunities for all learners and will have a profound effect on higher education as it blurs the lines between high school and college and degree programs and shifts society toward lifelong learning. [22] The possibility of taking distance learning courses at convenient times throughout the year will create enormous competition for students among higher education institutions. Since the full cost of an education will likely become the individual's responsibility, greater numbers of students will attend universities part-time and be highly motivated to shop around for the best solutions to their educational needs, whether they be in non-degree or degree programs held on- or off-campus.

If the Internet is to totally reshape education, it will have to move from the glitz of home pages to a conveyor of instructional content. Nevertheless, technology, in one form or another, will radically change the way society learns and provide some exciting resources for teaching and learning.

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Networks & Learning Environments: Responding to Growing Demands

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ABSTRACT

The nature and roles of campus networks are changing as its usage spreads across the campus, around the world and into an ever-increasing number of offices, dorm rooms, labs and classrooms. Technologically, it is evolving to include new forms of data like voice, image and video, as well as new technologies like FDDI and ATM.

In turn, these vast changes in network infrastructure will pave the way for introducing entirely new forms of management and learning as well as for increasing the effectiveness of the existing models.

How are institutions responding to what has become a seemingly never-ending demand for network access? Based upon the results of five annual surveys of higher education institutions, this paper will provide a trendline analysis of change -- between 1991 and 1995 -- and will focus on the areas of networks, network-based services, distance learning and other forms of technology-based learning environments. All analyses will compare the results for the entire higher education community in contrast to the major Carnegie classes.

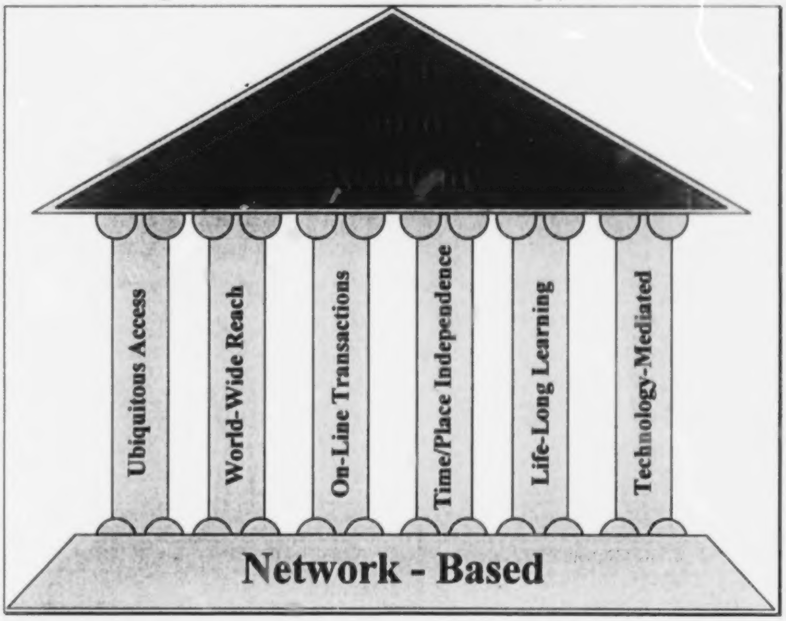
Introduction

This paper will examine the changing roles and nature of campus networks as its usage spreads across the campus, around the world and into an ever-increasing number of offices, dorm rooms, labs and classrooms.

The data for this paper are derived from our survey of Higher Education conducted during the spring of 1995, combined with data from four previous surveys conducted annually from 1991 through 1994. The text is further augmented by personal knowledge as well as by comments obtained from interviewing many leading Higher Education trendsetters. We begin by understanding the operational framework, within which the "21st Century Academy" will function.

The 21st Century Academy...

The following model is not intended to imply that we are entering an era in which all institutions will look alike. In fact, it is much more likely that we will enter the 21st century with not one model, but rather many. Further, we should expect a much higher level of differentiation among institutions, as they struggle to operate along the continuum of their core competencies in order to compete in an increasingly competitive market environment.



If not now, then in the near future, most institutions will plan and optimize -- to varying degrees -- along the following operational priorities: Ubiquitous Access; World-Wide Reach; On-Line Transactions; Time & Place Independence; Life-Long Learning; Technology-Mediation and Network-Based Operation. Will all institutions be fully engaged across these parameters by the turn of the century? Not likely! Clearly, not all institutions will offer courses on a World-Wide basis, but many students and faculty are likely to extend their research and collaborative undertakings to places outside the United States. Likewise, not all will offer corporate training or complete degree programs through distance learning, but some community colleges will offer English as a second language and skill certification on machine tools and CAD/CAM software. From the President's desk, to the janitor's closet, these operational priorities will drive performance and decisions for all stakeholders!

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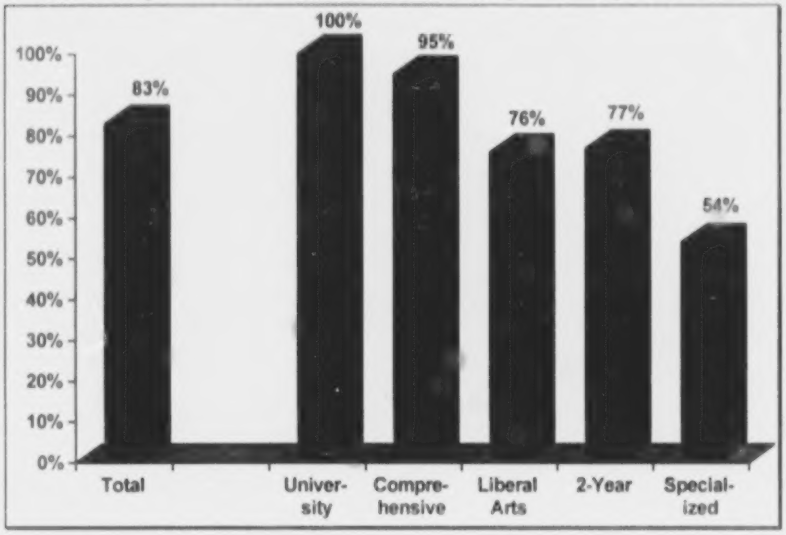
What role will technology play in all of this? Technology provides a base platform -- an infrastructure -- upon which higher education can re-frame itself in terms of both management practices and the delivery of instruction and research. And there is no technological element more important than the network...

Networks: The Enabling Infrastructure

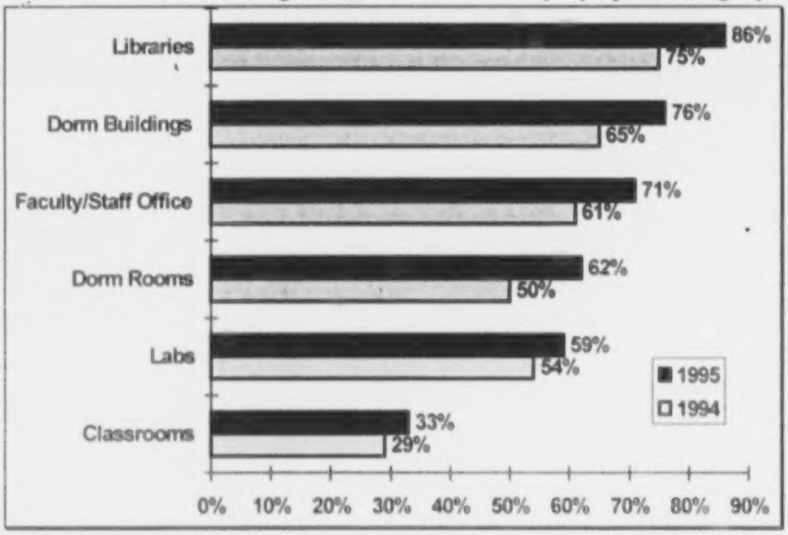
Access to networked-based resources is rapidly becoming the major enabler of the academic mission. Available networking technology is creating an unprecedented facility for sharing and collaboration among educators as well as presenting new expectations for services to students. How are institutions responding to what has become a seemingly endless demand for network access?

The first step in response to the networking challenge is, of course, to implement a campus backbone. Let's begin our look at campus networks by considering the change, since 1993, in the penetration of campus-wide networks. Overall, the percentage of institutions with a campus network increased slightly from 73% in 1993 to 75% in 1994 and finally to 83% in 1995.



Penetration of campus networks is now quite high, with 83% overall and 100% for universities. But the mere presence of a campus network is just the first step. The next issue concerns the types of buildings -- and therefore functions -- which are connected to the campus backbone. By looking into the types of buildings that are connected, we can understand how fast backbone connectivity is growing in key areas.

We have been measuring backbone connectivity by space category since 1991 and have found that the connectivity of all space categories has grown significantly.

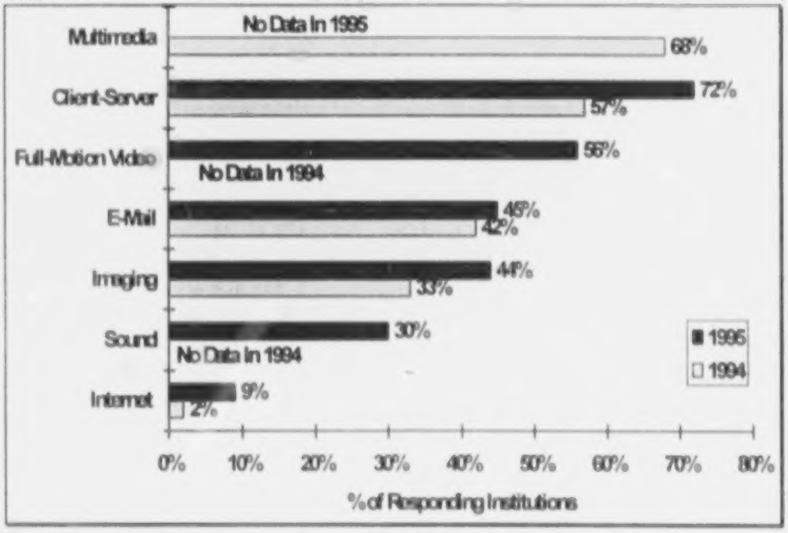


The following chart details connectivity growth between 1994 and 1995 in all space categories as follows: Classrooms grew from 29% to 33%; Dorm Rooms from 50% to 62%; Labs from 54% to 59%; Faculty/staff offices from 61% to 71%; Dorm Buildings from 65% to 76% and Libraries from 75% to 86%.

What's Driving Bandwidth Demand?

Bandwidth and money... who among us will admit to having enough? Campus-wide applications, like CWIS (Campus-Wide Information Services), e-mail, library access, client/server, and Internet applications -- along with increasing volumes of users -- each and all contribute to an ever-increasing demand for more bandwidth.

High bandwidth consuming applications such as multimedia will, by their nature, increase the demand for bandwidth, but the volume expectations of lower applications like e-mail also factor strongly into institutions' bandwidth requirements. In 1994, Multimedia topped the list, with 68% of all institutions responding. Further, the responses across the major Carnegie classes do not differ dramatically and range from a low of 21% in comprehensives to 29% in universities. In 1995, we decided to divide Multimedia into its two major

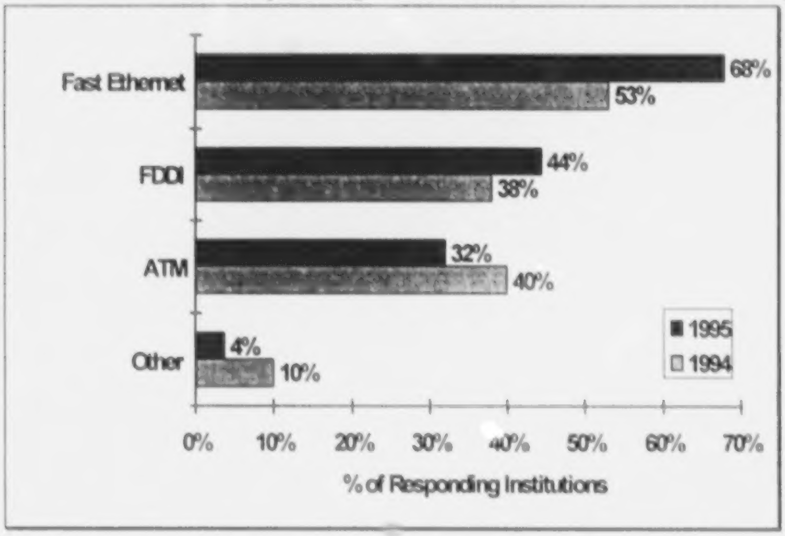


components of full-motion video and sound. The results indicate that full-motion video placed in the top three applications, while sound is near the bottom of the list, with only 30% of institutions responding. What's driving demand for full-motion video? We can only speculate that it is likely driven by the increasing demand for network based instructional and research resources.

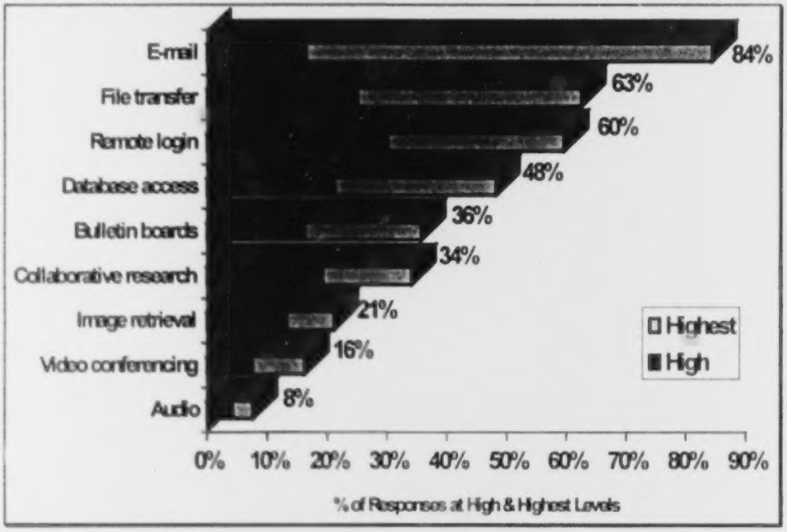
That client-server is at the top of the list is not a surprise. It is surprising, however, to find that so many institutions indicated e-mail as a major driver. E-mail was supposed to be a trick question. E-mail, by itself, is not a bandwidth hog, but an exponential increase in the number of e-mail users changes the equation. With just under half of all institutions responding to the e-mail category, we might infer that all institutions are gearing up for essentially ubiquitous access to e-mail. It appears that even the musicologists don't want to be Luddites!

Demand for bandwidth is an ever-present concern that comes with the territory of networking in higher education institutions today. Given the vast increases in "connected" campuses, along with the demand for high bandwidth applications, such as multimedia and imaging, we would expect to find many institutions planning to increase their network bandwidth... and we did. Overall, 68% are either currently -- or planning to -- increase bandwidth. We have estimated that more than 2,000 institutions are bandwidth shopping.

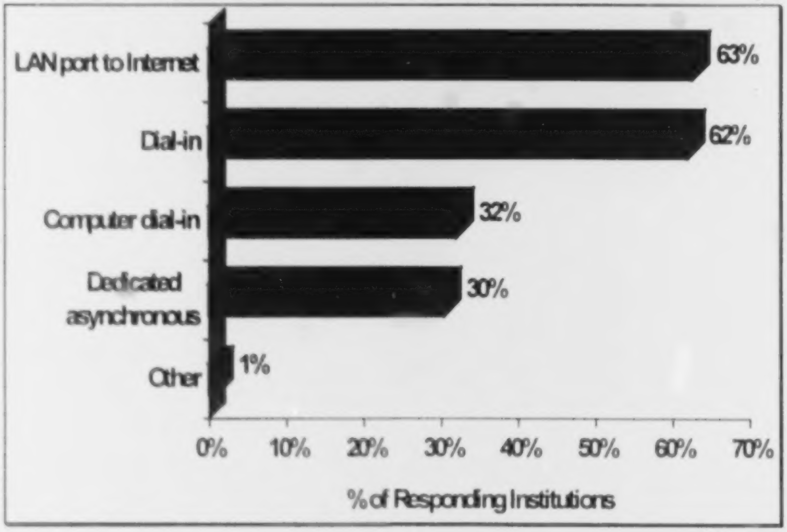
For those institutions planning to add bandwidth, which technologies are they planning to add? Fast Ethernet tops the list, with 68% overall -- up from 53% in 1994 -- and its demand is strongest in 2-year (75%) and specialized institutions, with 80% responding. FDDI is next, with 44% responding overall and up from 38% in 1994. It appears to be favored among comprehensive (43%) and specialized institutions (60%). ATM, with 32% -- down from 40% in 1994 -- continues to be favored by the largest institutions, with 59% of those with over 10K enrollment, responding.



The Net



The Internet... the much-touted solution to all problems, large and small... offers an enormous array of opportunities. Which Internet applications enjoy the highest use in higher education? We asked respondents to rate their institution's usage on a low-to-high scale of 1-5. The following chart describes the proportion of "high" and "highest" responses. For two years in a row, we found e-mail and its companion, file transfer, as the two highest-rated applications. In fact, for all applications -- except bulletin boards -- usage increased. Further, as we looked across the Carnegie classes, we found that Universities had the highest rate of usage, while 2-year schools had the lowest usage, across almost all applications.



... But all Internet access is not created -- or implemented -- equally! And given the 62% "dial-in" response to the question of what level of Internet access is provided, we can assume that "some number" of users -- across all Carnegie classes -- are accessing the Internet, at least some of the time, through dial-in. This results either because it is their only option or because it is the only option which is time and place independent. For example, most students and faculty may have network access to the Internet when in their office or in specific on-site labs, but may be relegated to dial-in when in their dorm rooms or homes. LAN port to the Internet, with 63% responding, was the most frequently mentioned form of Internet access. In general, the frequency of this response was positively correlated with enrollment. As an example, over 80% of all respondents with over 10K students responded. In contrast, only 42% of those institutions with fewer than 1,000 students mentioned this form of access. Dedicated asynchronous access was mentioned by only 30%. The universities and comprehensives lead with somewhat over 42% responding, while only 17% of the liberal arts colleges responded.

So much for the present networking situation. What is the prognosis for the future? From the perspective of campus network users, there is both good and bad news. The good news is that network investments needed to enhance basic infrastructure and to increase bandwidth are likely to continue. The bad news is that demand will continue to outstrip supply as more users "login" and demand more access... to send and receive more data, in more forms, to more locations, across the campus and around the world. The future looks like a continuing game of "catch up!"

And, networks aren't the only "catch-up" game being played in higher education. Our data suggest that technology integration into the curriculum is on an upward curve. The following section provides a view into what higher education institutions are doing today.

Technology-Mediated Learning: Are We There Yet?

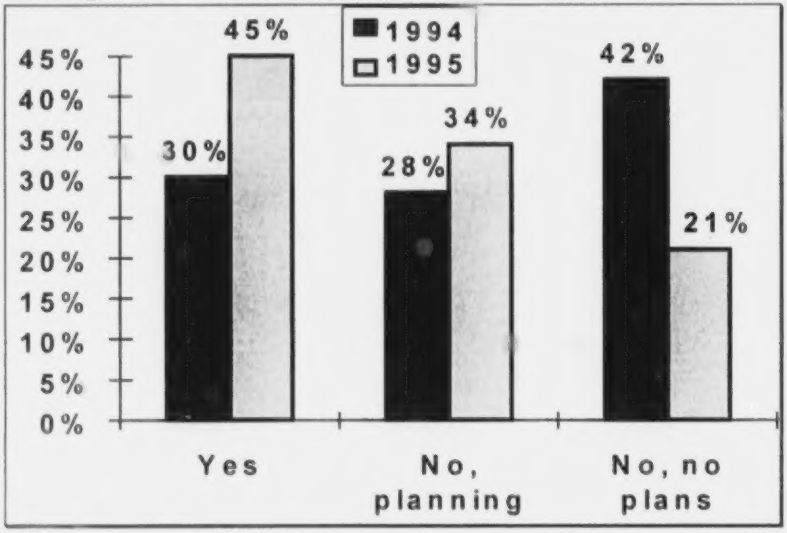
There are many who believe that education across all dimensions will be transformed as the boundaries become more porous -- or even disappear -- between home and school, education and entertainment, K-12 and higher education and formal education and life-long learning, thereby enabling education to become more time and place independent.

Perhaps the first formal step on the pathway to time and place independence is that of technology-mediated learning -- either distance or on-site. Technology-mediated learning means different things to individual institutions and to the individuals within them, and it encompasses many levels of the educational spectrum. In this section, we'll take a broad look at how technology-mediated learning is used in higher education today.

Distance Learning Involvement

To understand the current -- and planned -- state of distance learning activity in higher education, we begin by asking: How many institutions are either currently or planning to engage in distance learning?

Looking at the overall level of distance learning activity, we found that 45% -- up from 30% in 1994 -- of higher education institutions are currently engaged in some form of distance learning; 34% are planning (up from 28% in 1994) and only 21% -- down from 42% in 1994 -- have no plans. And there are further discernible patterns across the Carnegie classes. Combining the responses for "currently" and "planning," we find that 79% of all institutions are affected. Not surprisingly, there are marked differences across the Carnegie classes. The comparable responses for all other institutions are: Universities -- 96%; Comprehensives -- 92%; Liberal Arts -- 47%; 2-Year -- 85% and Specialized, with 80% responding.

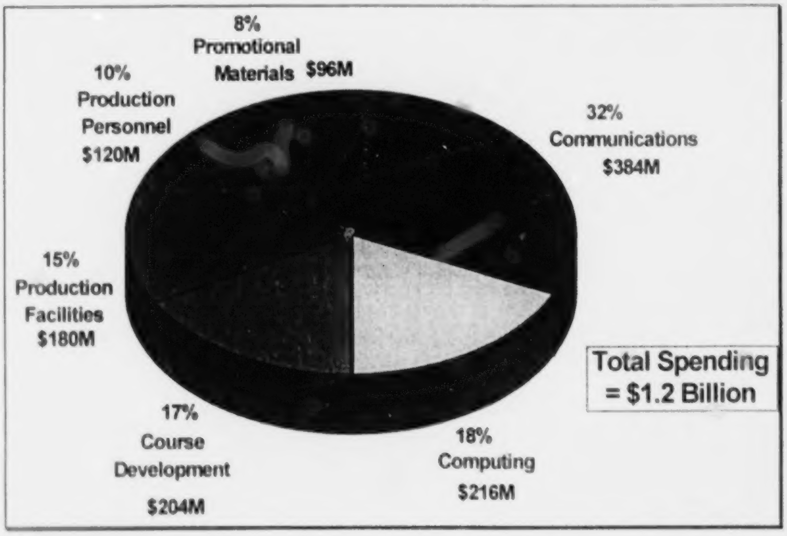


The commitment to engage in distance learning represents just one dimension of the overall picture of distance learning in higher education. A second key dimension is to understand what proportion of the total student enrollment is affected. As we might have expected, the percentage of students affected ranged widely from a high of 60% down to a low of only 1%. Overall, the mean percentage of affected enrollment was 11%.

Distance Learning Spending

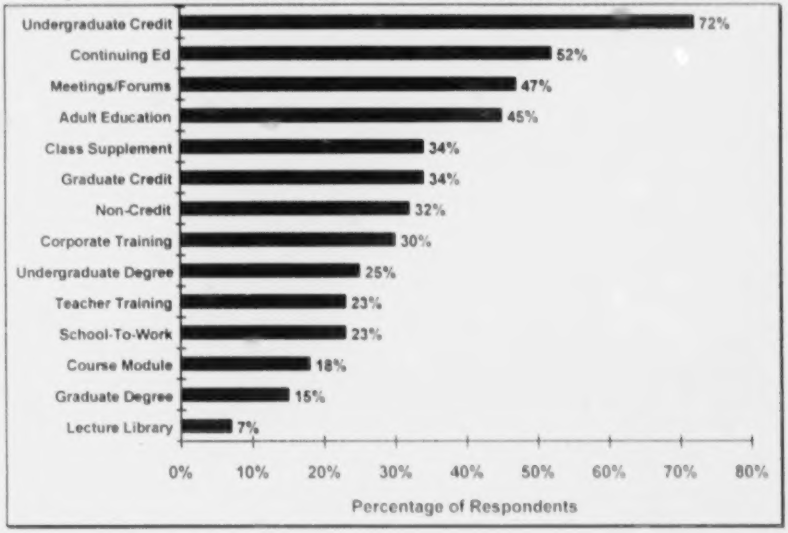
Another key element in understanding the magnitude and nature of distance learning involvement is the scale and allocation of funding for this activity. Distance learning funding is not always treated as a separate budget area, but instead, buried within many individual budgets, and, therefore it is difficult to accurately project the total spending in this area. We have estimated spending at $1.2 billion dollars...but it is likely to be understated. Perhaps more important than the total amount, is how distance learning spending will be apportioned. Understanding this split tells us much more than how expenses are apportioned. It provides clues into the nature of the distance learning activities to be offered.

We tested for allocations in six main expenditure categories: communications; computing; production facilities; production personnel; promotional materials and course development. Finding that 32% will be devoted to communications, or even that 18% will be spent on computing is not surprising. It is enlightening, however, to discover that 42% will be spent on production personnel and facilities and course development. Each of these three areas contributes to the development and production of specific distance learning programming. The ratios do change, however, across the Carnegie classes, and range from a high of 54% in universities to a low of 36% in liberal arts.



How Is Distance Learning Used?

It is particularly interesting to ask what proportion of respondents indicated that distance learning was used in the "real business" of higher education -- that is, to award undergraduate and graduate credits toward degree credentials. We found the following use patterns by institutions that have distance learning programs: 72 percent grant undergraduate credits (2-year schools lead); 34 percent grant graduate credits (universities and comprehensives lead); 25% grant undergraduate degrees; and 15% grant graduate degrees (universities lead).

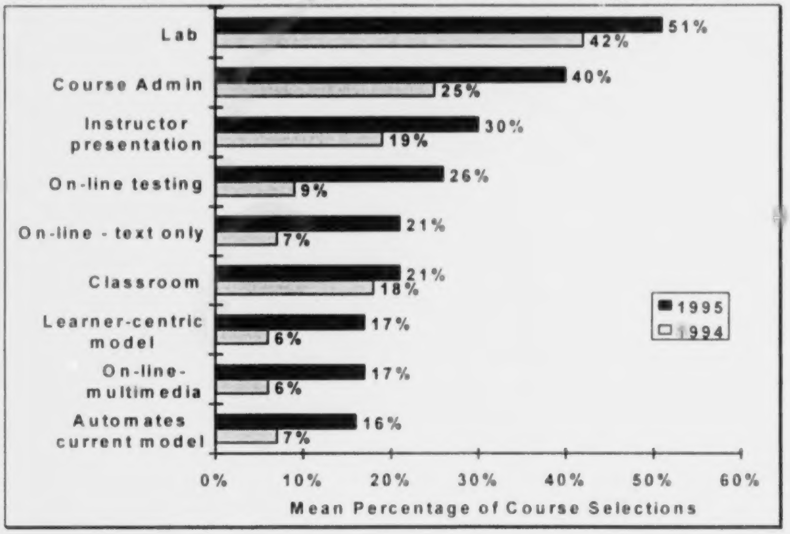


These data present only a baseline understanding of where we stand today. Perhaps the more intriguing issue may be to address the longer-term questions that are beginning to enter into discussions of distance learning: Will distance learning be used increasingly to offer complete undergraduate and graduate degree programs, and if so, will this new medium enable more aggressive and previously unused competitive tactics in the pursuit of new students? Will this result in chaos and unfair competition among educational institutions, or will we perhaps see educational resources distributed in a manner which better meets the needs of all Americans? Who will win, and who will lose? Stay tuned...

So, Are We There Yet?

The prognosis for the future is rosy, but many would argue that the present, when looking across the entire higher education landscape, is quite bleak and that it will take years -- perhaps decades -- before most institutions will be able to implement new learning models -- either on-site or distance -- across the curriculum.

What are institutions doing today? How is technology used in courses? The following chart describes the mean proportion of course sections using various forms of technology. We might have expected that 51% -- up from 42% in 1994 -- of all lab sections would use some form(s) of technology, but were pleasantly surprised to find that technology was involved in the mainstream instructional activities of approximately 20 percent or more of all course sections for the following uses: in the classroom; on-line materials; on-line testing; instructor presentation, as well as course administration. Further, it was very encouraging to be able to account for a 16-17% presence of emerging activities like on-line testing and on-line access to multimedia materials.



While the data and analyses may not reflect a realization of utopia, it does appear that technology integration is on an upward curve. What are the impediments to faster progress? Certainly, there are legitimate concerns with regard to funding, technological maturity, the cost-benefit analysis of these new learning models, as well as the propensity of higher education to resist change. These are not insignificant challenges. With luck, these challenges will be offset by the vision and leadership of many who believe that funding can be found and solutions can be implemented if institutions -- and their leaders -- are willing to focus more on institutional effectiveness and less on the status quo!

Altering Time and Space through Network Technologies to Enhance Learning

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Abstract

This paper maintains that networking technologies offer a better learning environment for students while providing opportunities for reducing the cost of the learning process. A key outcome of advances in networking, the Internet, telecommunications, and client/server computing, is that they are serving to alter the limitations of time and place. The authors discuss their experiences from the perspective of teaching in economics and the arts. They have created learning strategies that make use of these technologies for communication and access according to a matrix showing the interaction of time and place. These include private news groups for each class; e-mail collaboration between students and between students and instructors; electronic submission and critique of work; electronic posting of grades, handouts, notices, schedules, etc.; electronic exhibit areas for multimedia and World Wide Web class projects; Internet-wide critique of work; Internet-based research projects; and the use of localized Internet servers dedicated to instruction.

Altering Time and Space through Network Technologies to Enhance Learning

John F. Chizmar, Department of Economics
David B. Williams, College of Fine Arts
Illinois State University

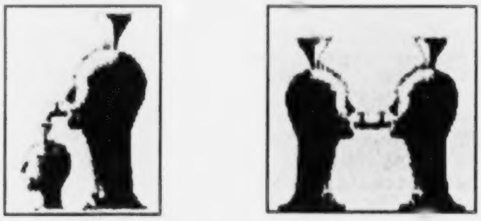
A paradigm shift is taking place in higher education. According to Barr and Tagg (1995), the paradigm that has governed our universities is one that defined a university as "an institution that exists *to provide instruction.* Subtly but profoundly we are shifting to a new paradigm where a university becomes an institution that exists *to produce learning.*" (p. 13) We are beginning to recognize "that our dominant paradigm mistakes a means for an end. It takes the means or method—called "instruction" or "teaching"—and makes it the [university's] end or purpose.... We now see that our mission is not instruction but rather that of producing *learning* with every student by *whatever* means work best." (p. 13)

Our paper addresses the following questions: will computing and networking technologies offer a better learning environment for students? Will these technologies improve our ability to help students produce learning while reducing the cost of instructional? We believe that the answers to these questions is a resounding "yes," if computing and networking technologies are used to create learning strategies that involve students as active partners in their own learning.

In the search for active learning strategies, we are guided by two principles stated by Cobb (1993, p. 20):

- The student and teacher share responsibility for the quality of a process— the process of the student's learning (only indirectly and secondarily the quality of the teacher's teaching.)
- The core motivation, for both student and teacher, should be the satisfaction that derives from improving the quality of the student's learning.

Our goal as teachers in using computing and networking technologies is, to use a metaphor, to be a "guide on the side" instead of a "sage on the stage." To return to Barr and Tagg's (1995, p. 24) terminology, our goal is to move from an "instruction paradigm," in which a faculty member's role is "actor" and knowledge is transferred from faculty to students, to a "learning paradigm," in which a faculty member's role is "inter-actor—a coach interacting with a team" and students discover knowledge for themselves. We illustrate these contrasting paradigms in Figure 1.



Sage-on-the-Stage Guide-on-the-Side

Figure 1. Two instructional strategies: The Sage-on-the-Stage and the Guide-on-the-Side[1]

Enhancing the Learning Process through Networking Technologies

In order to understand how technologies can support and enhance the quality of student learning and increase active participation by students, we share, in this paper, our experiences with implementing active learning strategies that use computing and networking. Chizmar teaches undergraduate statistics and econometrics courses in a networked computer classroom where each student works on a computer workstation connected to the campus network and the Internet.

Williams teaches two seminars on developing and designing computer applications in the arts. The first course focuses on designing multimedia applications with Powerpoint, Authorware, and HyperCard; the second course focuses on designing electronic arts exhibits on the Internet using a Web server, HTML coding, and a variety of graphics and music creative software tools. These courses take place in a traditional conference room with a computer teaching station, an overhead display, and a connection to the campus network and the Internet. Williams's students also use a portable computer-lab-on-wheels on occasion in the classroom—a number of laptop computers are available on a cart, with wireless infrared networking—and they have access to a networked computer lab for work outside of class.

Networking and Internet connectivity is critical to our teaching strategies. We use a combination of AppleTalk for local networking and file sharing and TCP/IP connectivity to the Internet through MacTCP over Ethernet or Token Ring to the campus backbone (ISUNet). Chizmar's web server is WebStar running on a Mac PowerPC in the economics department computer lab. Williams's web server was originally a Mac server, but is now an SGI Indy running a Netscape server from the College of Fine Arts.

The network and server facilities that we have in place, provide for our students, to use Larry Smarr's phrase, a "window into knowledge space" (1992). Smarr asserts that we are experiencing today the fruits of a major transition from a world of one person, one computer to a world of the "meta-computer," a computer of computers. In this new world, a personal computer becomes a "window into knowledge space" and a gateway to virtual resources. But meta-computing does more than provide a looking glass through which to see the world. We believe that meta-computing also creates a looking glass that reflects back to the learner an image of him or herself working with other learners. Meta-computing enables learning by providing diverse modes of communication and access to a creative, virtual collaborative space for students.

Here is just a sample of some of the learning activities possible in our networked, meta-computing environment at Illinois State University:

- Private news groups for each class
- E-mail collaboration: student-to-student, student-to-instructor, and instructor-to-student
- Electronic submission and critique of work
- Electronic posting of grades, class handouts, notices, schedules, etc.
- Electronic exhibit areas for class projects
- Internet-wide critique of work
- Internet-based research projects.

In the remainder of this paper, we present examples of how we implement these activities in our classes. We find it useful to view these activities in terms of a time-and-place matrix, a concept we borrowed from writings on groupware strategies (Johansen 1992) and adapted to our work. A key outcome of the advances in computer networking and the Internet is that they are serving to *alter the limitations of time and space*. Each cell in the matrix (see Figure 2) demonstrates this by representing unique combinations of time and place events in fully networked learning environments. We start with same-time/same-place (representing the traditional classroom) and progress clockwise through different-time/different-place. You will see that, while we employ strategies that cover all the cells, they differ in Williams's use of networking to enhance creative opportunities for his students and Chizmar's use of networking to enhance collaborative activities.

Same-Time/Same-Place Instruction: Traditional Meeting Places

Same-time, same-place describes the traditional classroom, rehearsal room, conference room, or computer lab. Our definition of "place" here includes both physical space (e.g., the classroom) as well as virtual class space (e.g., a dedicated server holding students' work and instructor's materials much as a work room or team room would be used).

Most efforts at incorporating technology into instruction have been focused on this cell of the matrix. This cell includes any meta-computing learning strategy that improves the ways in which students traditionally learn within the confines of meeting for 50 minutes, three times per week (same time), in the same classroom (same place). Such strategies include collaborative or groupware applications and experiences, in-class demonstrations, practical experiences especially with simulations, experiences with software applications, and in-class access to student and course on-line files. Chizmar makes use of simulation and in-class electronic collaboration and feedback within the same-time/same-place cell of the time-place matrix. Williams uses the computer for demonstration, hands-on practice, and critique of student work within this cell.

Time and Place Matrix

Place

		Same	Different
Time	Same	Traditional classrooms and meeting places	Virtual classrooms, distance experts, distance tutors
	Different	Computer labs and team on-line servers	E-mail, news groups, Gopher and Web servers

Figure 2. The time-place matrix showing instructional activities possible in a networked learning environment.

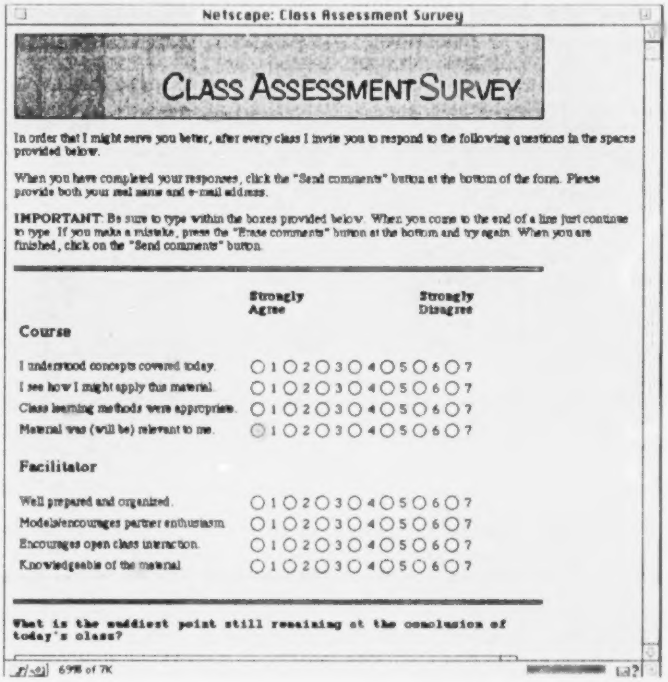
Economics. Chizmar uses statistical computing in a local area network setting to augment traditional face-to-face classroom instruction and to achieve the recommendations of the American Statistical Association and the Mathematical Association of America for the teaching of introductory statistics courses. These recommendations suggest that teachers should motivate students by showing them statistics at work in real applications, problems, cases, and projects; use real data and statistical computing; foster active learning; and downplay formal training in probability in favor of "exploring how useful ideas of statistical inference can be [learned] independently of technically correct probability." (Garfield and Ahlgren, 1988, p. 46)

The last recommendation presents a conundrum. How can students gain an intuitive understanding of the concepts of probability by eschewing its formal study? Answer—through the use of computer simulation. Chizmar presents the central idea of a sampling distribution through a series of Monte Carlo simulation experiments. The Monte Carlo experiments give students an intuitive understanding of the Central Limit Theorem and can easily be answered using statistical computing. From their computer workstations in class, each student generates 20 random samples of the same size from the same population and for each sample calculates the mean and median. They then send Chizmar an e-mail message which contains their 20 means and medians. Again, within the class time, Chizmar combines each students response with the responses of the other students and then e-mails these class distributions of the means and medians back to the students for further analysis.

Chizmar uses e-mail and a class LISTSERV to augment an active learning strategy called "think-pair-share." This activity takes place collaboratively during class time. To help students clarify their thinking, Chizmar asks each student to write an e-mail message to the class LISTSERV, explaining, *in words their fellow students will understand*, a particularly difficult concept, a p-value for example. Students then read what other students have written and discuss differences or similarities with their teammates. The advantage of the LISTSERV in this context is that students know that their message is sent to the entire class. This version of "think-pair-share" is based on Meyers and Jones (1993) observation that "when we direct students to write to each other, they usually write with more clarity and precision." (p.25) Klass (1995) has also observed when using LISTSERVs for political science writing activities, that when students write to a larger audience, in contradistinction to writing to the instructor, their writing in substantially better.

Chizmar also uses network computing to provide frequent feedback on the quality of student learning through a technique called the "One Minute Paper."[2] A typical One Minute Paper asks students to respond, in the final minute or two of class, to two questions: (1) What is the most important thing you learned today and (2) What is the muddiest point still remaining at the conclusion of today's class?

The first question is intended to focus students on the big picture, i.e., what is being learned, and the second to provide specific statements of what students want to know more about, i.e., how well it is being learned. Chizmar has incorporated these question plus a set of Likert-scale questions developed by Shulman (1995) into a Netscape form (see Figure 3) which students complete at the conclusion of every class.[3] The form creates a tab-delimited text file of the students responses which can be easily analyzed in Excel and Minitab. Furthermore, because the form also asks students to provide their e-mail addresses, Chizmar can respond immediately via e-mail to any student who seems particularly "muddy."



In order that I might serve you beter, after every class I invite you to respond to the following questions in the spaces provided below.

When you have completed your responses, click the "Send comments" button at the bottom of the form. Please provide both your real name and e-mail address.

IMPORTANT: Be sure to type within the boxes provided below. When you come to the end of a line just continue to type. If you make a mistake, press the "Erase comments" button at the bottom and try again. When you are finished, click on the "Send comments" button.

	Strongly Agree						Strongly Disagree
Course							
I understood concepts covered today.	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
I see how I might apply this material.	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Class learning methods were appropriate.	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Material was (will be) relevant to me.	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Facilitator							
Well prepared and organized.	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Models/encourages partner enthusiasm.	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Encourages open class interaction.	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Knowledgeable of the material	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

What is the muddiest point still remaining at the conclusion of today's class?

Figure 3. A Netscape form for the "One Minute Paper"

Before the next class, Chizmar creates a Pareto chart (a quality principles analysis tool) of the students' feedback and fashions an e-mail message back to the students which contains the chart plus their verbatim responses to the One Minute Paper from the previous class. Students find the latter practice informative because it tells them, in unabridged language, that other students are muddy about the same points as they. Chizmar begins the subsequent class with a discussion of their responses, in essence, with feedback on student feedback. Chizmar observes that student responses became more thoughtful and useful as it becomes clear that he really does intend to use student feedback to manage and guide the course.

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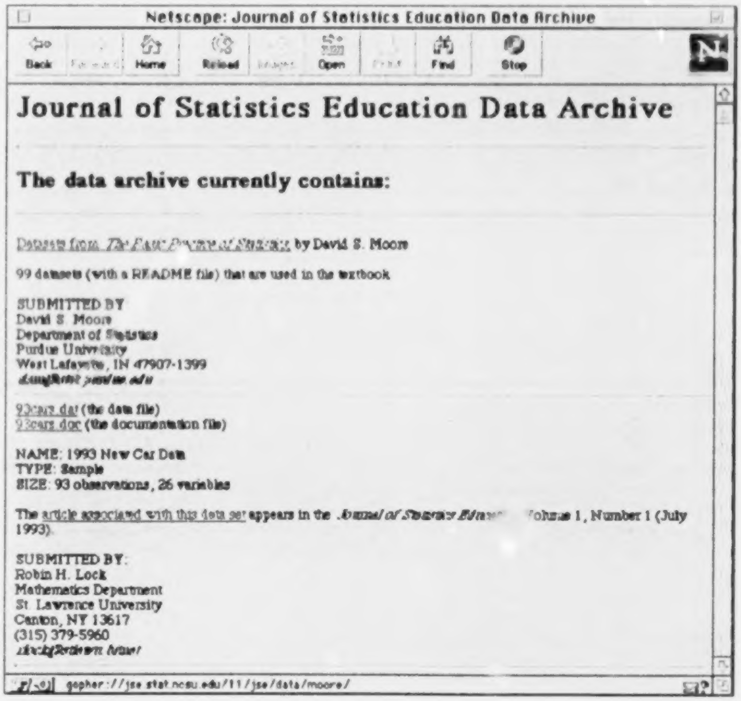
Fine Arts. Williams prefers a constructionist strategy of teaching with a strong emphasis on learning projects. A key strategy for the use of class time is viewing and critiquing work in progress. The guidelines for statistical study with emphasis on motivation, real-world problems and projects, and the downplay of formal training, apply here in the arts as well.

Williams uses the teaching workstation and its connection to the network to quickly access student work from the department server where class and private student folders permit electronic storing of assignments and work in progress. Students have an on-line folder for their work that only they and the instructor have access to. Having electronic access to all student projects makes it easy to quickly show and compare portions of students' work and to isolate examples of problem areas in software and instructional development that need class attention. When hands-on is needed for learning new software development tools, as in Chizmar's class, the portable lab-on-wheels can be rolled into the classroom.

Same-Time/Different-Place Instruction: Lowering the Walls of the Classroom

Same-time/different-place computing lets us expand beyond the classroom. Here is where we "lower the walls" and open the "window into knowledge space." Using the power of network connectivity and advances in cable and the telephony, collaboration takes on an expanded meaning. Any group of people can be brought together for a meeting at the same "time" without regard to "place." We can hold text-based conferences (on-line chat groups), audio conferences (phone conferencing), and full-audio and video conferencing right from our desktop (desktop video presentations). Tutoring can be offered remotely. Mentors or experts can be brought into the classroom from anywhere in the world. Many programs are now offering their courses and degree programs on-line, letting students complete some, if not all, of their work remotely.



Journal of Statistics Education Data Archive

The data archive currently contains:

Datasets from *The Basic Practice of Statistics* by David S. Moore

99 datasets (with a README file) that are used in the textbook

SUBMITTED BY
David S. Moore
Department of Statistics
Purdue University
West Lafayette, IN 47907-1399
[illegible]

93cars.dat (the data file)
93cars.doc (the documentation file)

NAME: 1993 New Car Data
TYPE: Sample
SIZE: 93 observations, 26 variables

The article associated with this data set appears in the *Journal of Statistics Education*, Volume 1, Number 1 (July 1993).

SUBMITTED BY:
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(315) 379-5960
[illegible]

gopher://jse.stat.ncsu.edu/11/jse/data/moore/

Figure 4. A web page view of the on-line Journal of Statistics Education.

BEST COPY AVAILABLE

Fine Arts. Williams uses the teaching station's connection to the Internet as a way to open the classroom to world-wide people resources. Active participation from the class on USENET newsgroups provides input and assistance from people throughout the Internet for information, problem solving, and even critique of student work. The newsgroups provide informal distance experts. Prearranged e-mail (using Eudora) and chat conferences are scheduled to synchronize with class time so that distance experts can share their talents, contribute to a class discussion, or help the students solve particularly difficulty problems or locate resources. Using Fetch, TurboGopher, or Netscape, a particularly rich resource of graphic images or music sound files can be queried and the files downloaded to the classroom for discussion and experimentation.

Economics. Chizmar uses the student station's connection to the Internet similarly. Students, working in teams, use Netscape to access laboratory experiments designed to actively engage them in the study of statistics. One experiment, entitled "An Internet Journey" and adapted from an article written by Rossman (1994), asks students to answer a series of conjectures about life expectancy and density of people per television set in various countries. Working in teams of two, they link to an on-line journal, the *Journal of Statistics Education*, and retrieve a set of the data files across the Internet and import them into the statistical software, Minitab, for further analysis.

Future applications. There are other same-time/different-place activities which Williams and Chizmar intend to implement in the future: desktop video conferencing to bring distance experts and demonstrations into class in real time, prescheduled on-line tutoring for students with the instructor or a graduate assistant through controlled use of Internet chat groups (IRCs), and even the possibility of permitting students to attend the class remotely through desktop video conferencing.

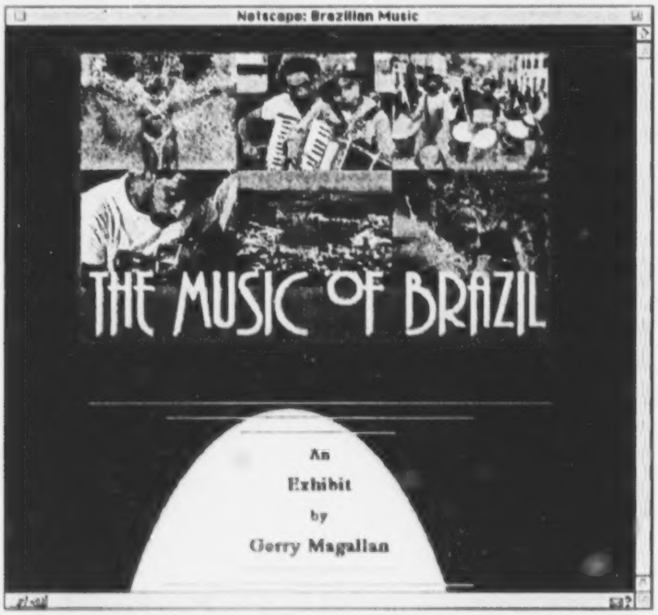
Different-Time/Same-Place Instruction: Virtual Shared Space and Computer Labs

This cell includes any learning activity which gives the instructor and students physical or virtual use of a dedicated workspace, any time they choose. Virtual team rooms, so to speak. We both provide local servers of information dedicated to class use, both for personal storage of work and for shared storage. This cell also would include dedicated physical workspaces. Our students have access to networked computer labs which they can use for "different-time" computing activities.

Chizmar and Williams both use a series of Web pages to organize on-line course content, where materials dedicated to their courses are stored. Students can find electronic versions of hand-outs and course syllabi. The well-worn plea for another copy of a lost handout is now followed by the rejoinder of "just download a new copy from the class server." Grades are posted electronically after each assignment for those students who give the instructor permission to post grades. We make a GIF graphic image of a class spreadsheet and post it in the class server space where only the students in the class have access for downloading. Course materials for Williams's class can be viewed at http://orathost.cfa.ilstu.edu/public/oratClasses/ORAT389.88Seminar/InternetModels/internetmodelshome.html and Chizmar's class, at http://138.87.168.39/Jack_Chizmar/ECO131/Eco131home.html.

Fine Arts. Williams's class makes extensive use of this cell and the virtual team room concept. Students construct off-line multimedia arts exhibits in the first semester course (Software Design in the Arts) and on-line multimedia exhibits in the second semester course (Internet Models for Artistic Expression). For these courses, students select a theme to develop for an exhibit which will be used throughout the semester. They then begin to design and accumulate a variety of digital imagery for their exhibits in private folders on the class server: digital graphics, digital video clips, MIDI music files, digital sound samples, text documents, and so on. Learning how to prepare such imagery, suitable to the multimedia platform they are working with (e.g., slide-, icon-, card-, or document-based tools), and of high aesthetic design quality, is a key goal of the course. The students then combine these images with Powerpoint, Word, Authorware, and HyperCard for the first semester course; HTML and Web page design for the second semester course. Examples of the work from the Internet Models course can be viewed through Netscape at http://orathost.cfa.ilstu.edu/public/oratClasses/ORAT389.88Seminar/InternetModels/exhibits95.html.

Williams provides each student with a private folder where only that student and the instructor can gain access to the materials. Special "drop folders" are created for submitting work electronically; files can be "dropped" in but only the instructor can take them out. Williams also creates on-line folders for each class project where students can share the results of their work with the class, and for the Internet Models course, with the Internet community at large. In fact, Williams requires his students to announce their completed projects on the Internet newsgroups and invite the public to electronically critique and react to their work. A local USENET newsgroup is created just for the class; this serves as an electronic bulletin board for the students and the instructor. Posts for help, advice, announcements, helpful tips, and coordinating student teamwork all circulate through the class news group over the semester. Williams feels that a LISTSERV would provide a more controlled environment for a collective newsgroup over the Internet. LISTSERVs are a good way to implement on-line critiques of work where several on-campus classes participate, or better still, where the same class at several different campuses share work with one another.



THE MUSIC OF BRAZIL

An
Exhibit
by
Gerry Magallan

Figure 5. An example of a student arts exhibit on Brazilian music

Economics. Chizmar has begun to experiment with out-of-class team projects. While exams and projects assess student understanding equally well, projects (especially team projects) more than exams are themselves instruments of learning. Because students teach each other, team projects promote student learning and empower students to own their own learning. The benefits of team projects can be substantially enhanced with the use of networking technologies which help to ameliorate a major complaint of student team members—that it is difficult to schedule a common time and place when everyone can meet to work on the project. Instead, telecommunication and networking technologies expand place and time by permitting students to collaborate in the same place, but at different times.

Different-Time/Different-Place: Access to the World of On-line Information

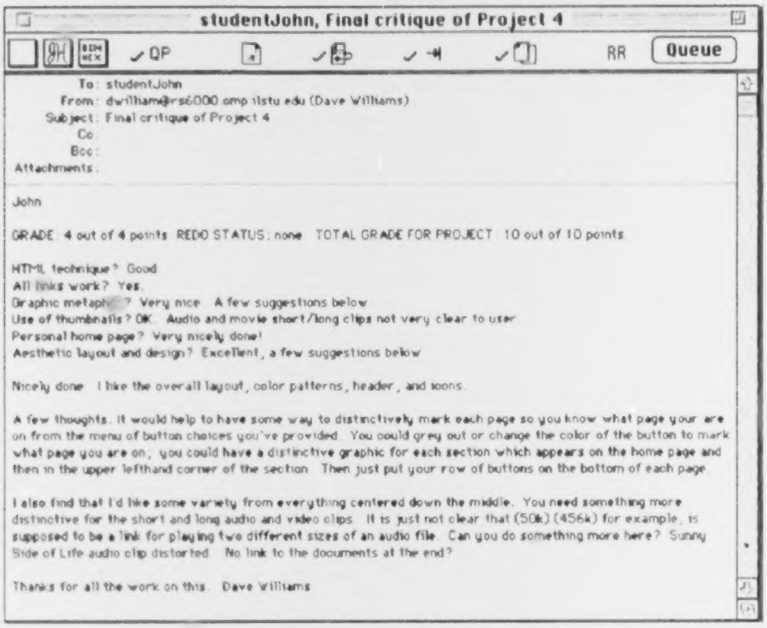
The different-time/different place cell represents true "anywhere-anytime" computing. The freedom to participate at "different times" and "different places" lets the instructor and the students plan and control their participation and use of network resources to suit their own schedules and preferences. Through the World Wide Web and Gopher, data, software, and a wide array of graphic images, sound and music files, and digital movies can be transported to the classroom for use and demonstration. There are millions of servers with full-text documents, abstracts, on-line library catalogs, MIDI music files, digital sound samples, graphic images and digital video clips, software, and statistical data. The list is endless. Any location on the Internet containing these resources can be accessed at anytime.

Electronic mail, of course, is the most widely used different-time/different-place technology. With extensive use of e-mail for both students and faculty at Illinois State University, we have found that it has a great "social-leveling" or "equalizing" effect. When you interact with people through text only, people anywhere in the world, some of whom you have never met, the exchange is free from biases that are caused by visual appearances. We have found that students are much more likely to seek help from us via e-mail, then make an appointment to see us in our offices. We have also found that students are more likely to seek help from each other through e-mail, or from anyone in the world for that matter. One student from Williams's class convinced Guy Kawasaki to help him with his assignment simply because Mr. Kawasaki was impressed and intrigued by the way the student presented the problem to him (and found his e-mail address besides); another student managed to get help with multimedia copyright law by convincing a Harvard law student, through e-mail, to find the copyright information in the Harvard library.

Other examples of using networks for different time/different place collaboration include electronic newsletters and journals, and electronic forums or LISTSERVs and USENET news servers.

Economics. We have already discussed Chizmar's electronic adaptation the One Minute Paper. Chizmar also uses computing to augment another CQI (Continuous Quality Improvement) teaching strategy, the Quality Circle. A circle of six to twelve student volunteers meets weekly with Chizmar to provide advice and feedback on course management issues. Through the Quality Circle, students experience the direct application of simple statistical tools and procedures to a problem they know intimately—achieving learning of highest quality. Chizmar uses e-mail to facilitate the work of the Quality Circle—devising a fishbone diagram, constructing a class survey, composing recommendation to improve the course—and a LISTSERV to involve the remaining members of the class in the work of the Quality Circle any time, any place.

Fine Arts. This cell in the time-place matrix is another important one for Williams's classes since students must conduct an extensive amount of research in developing their theme and thematic materials for the multimedia projects. One of the first projects in the Internet Models course is an Internet Treasure Hunt. The dual goals of the project are to acquaint the students with the basic Internet client tools for news, gopher, ftp, and web and to get them started with researching their topic area. The treasure hunt asks them to locate sites for graphic images, sound files, content information on their topic, information on copyright related to multimedia and the Internet, experts that can help them with their project, and grant and funding resources should they hypothetically need to seek financial support for the project.



To: studentJohn
From: dwilliam@rs6000.cmp.ilstu.edu (Dave Williams)
Subject: Final critique of Project 4
Cc:
Bcc:
Attachments:

John

GRADE: 4 out of 4 points REDO STATUS: none TOTAL GRADE FOR PROJECT: 10 out of 10 points

HTML technique? Good
All links work? Yes.
Graphic metaphor? Very nice. A few suggestions below
Use of thumbnails? OK. Audio and movie short/long clips not very clear to user
Personal home page? Very nicely done!
Aesthetic layout and design? Excellent, a few suggestions below

Nicely done. I like the overall layout, color patterns, header, and icons.

A few thoughts. It would help to have some way to distinctively mark each page so you know what page your are on from the menu of button choices you've provided. You could grey out or change the color of the button to mark what page you are on; you could have a distinctive graphic for each section which appears on the home page and then in the upper lefthand corner of the section. Then just put your row of buttons on the bottom of each page.

I also find that I'd like some variety from everything centered down the middle. You need something more distinctive for the short and long audio and video clips. It is just not clear that (50k) (456k) for example, is supposed to be a link for playing two different sizes of an audio file. Can you do something more here? Sunny Side of Life audio clip distorted. No link to the documents at the end?

Thanks for all the work on this. Dave Williams

Figure 6: An example of a e-mail critique of student work.

Williams also uses both on-line newsgroups and e-mail extensively in his class. Students are encouraged to use e-mail to communicate and collaborate with each other, and with the instructor. Through a combination of e-mail and newsgroups, students begin to think in terms of the learning process and the course of study being a 24-hour-a-day, seven-days-a-week experience, rather than a 50-minute-a-day, three-days-a-week experience; students, the instructor, and peers and experts worldwide, are always within reach.

Student work is submitted electronically through the class drop folders, and all work is critiqued with feedback being returned electronically to the student through e-mail. Figure 6 shows a sample e-mail critique. A standard template is used for each project that emphasizes the key objectives and criteria for the project. With on-line course materials, electronic submission of work, and e-mail critiques, no hardcopy or paper work exchanges hands during either of the fine arts courses (except for the class registration list and grade submission which still use op-scan forms!).

Reducing the Cost of Instruction

So far, we have addressed the question of whether using networked technologies can improve the quality of student learning and increase active participation by students. Obviously, our answer is a resounding "yes." In the conclusion of this paper we would like to address the question of whether we can show a reduced cost of learning per student as the result of the innovations we have discussed.

Notice that we state the question in terms of the cost of learning per student rather than in terms of the cost of instruction per student. In this distinction, we agree with Barr and Tagg (1995) when they say, "Under the Learning Paradigm, producing more with less becomes possible because the more that is being produced is learning and not hours of instruction. Productivity, in this sense, cannot even be measured in the Instruction Paradigm [university]. All that exists is a measure of exposure to instruction." (p. 23)

This distinction is not the usual ploy of defining away the problem, but rather of defining the problem properly in the first place. If we take learning as the proper metric, then we have no choice but to adopt learning strategies that produce active, involved learners. The lecture-discussion, the primary means of producing instruction in American universities, does produce a lower cost of instruction than active learning strategies. But we have increasing evidence that the lecture-discussion is ineffective at producing learning. As stated by Guskin (1994), "the primary learning environment for undergraduate students, the fairly passive lecture-discussion format where faculty talk and most students listen, is contrary to almost every principle of optimal settings for student learning." (p. 6)

We also need to consider that increases in learning are difficult to demonstrate empirically because of what economists call "satisficing" behavior on the part of students. When given the opportunity through an active learning strategy, say, to learn more or to learn the same amount as previously more cheaply, students may rationally choose the latter because they too face competing demands—other classes, jobs, leisure—for their time. It strikes us, however, that insisting that there must be empirical evidence that active learning strategies coax out more learning than the lecture-discussion format is a little like insisting that before doctors could prescribe penicillin there must have been controlled experiments that demonstrated penicillin's effectiveness. Doctors who prescribed penicillin did not need a study to see that their patients got better. Teachers who use active learning strategies do not need a study to see that their students learn more.

As a consequence, asking whether active learning strategies produces instruction at lower cost than the lecture-discussion, asks the wrong question. Rather we should be asking whether the learning produced by whatever strategy can be produced more efficiently. Here is were technology enters the picture.

As we have shown, networked computing, and, in particular, meta-computing, can be used to adapt already proven active learning strategies and produce the same or increased learning more cheaply. In terms of what? Primarily in terms of faculty time.

As faculty ponder whether to adopt more active learning strategies, they rationally compare costs and benefits. From a faculty member's perspective, the cost of the technological backbone is a sunk cost. The sunk nature of the backbone is illustrated in a recent Doonesbury cartoon (November 28, 1995). Mike Doonesbury engages a colleague in the following dialogue:

Mike: Hank, what's a Web site?
Hank: It's an Internet presence.
Mike: What's on it?
Hank: It doesn't matter. Build it and they will come.
Mike: Why do we need one?
Hank: Because the technology exists. Also, everyone else has one.
Mike: What's my motivation?
Hank: Fear. Greed. Take your pick.

Universities have built it, but will faculty come? The primary cost that faculty members face as they ponder change is the cost of their own time. As it becomes clearer to faculty that they must give up the instruction paradigm in favor of the learning paradigm, faculty members will seek out ways to produce acceptable levels of learning with smaller and smaller investments of their own time. In this paper, we have discussed ways in which technology can be used to produce learning a lower cost in terms of faculty time.

The real question is what forces will cause faculty to change from an instruction to a learning paradigm, from the sage-on-the-stage to the guide-on-the-side. It is clear that this change is very costly in terms of faculty time, and that incentives must be created to induce this change. Perhaps Doonesbury is correct and the answer is "fear and greed." We rather hope that the answer lies in a deeply felt understanding that the raison d'être of a university is not to produce instruction but rather to produce learning and that the traditional teaching strategies are ineffective. Again, in the words of Barr and Tagg, a university's purpose is "not to transfer knowledge but to create environments and experiences that bring students to discover and construct knowledge for themselves, to make students members of the communities of learners that make discoveries and solve problems." (p. 15)

Author Notes

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Information Systems, the Office of Research in Arts Technology, and the Department of Economics at Illinois State for their support for this project. Dr. John F. Chizmar (jfchizma@ilstu.edu) is Professor of Economics and may be contacted via e-mail or mail through the Department of Economics, Illinois State University, Normal, IL 61790-4000; Dr. David Williams (dwilliam@ilstu.edu) is Associate Dean for Research and Technology in the College of Fine Arts and may be reached through the College of Fine Arts, Illinois State University, Normal, IL 61790-5600.

Footnotes

[1] These figures were digitally created by D.B. Williams from an original graphic of a sage-on-the-stage-like image by an unknown artist. We have not been able to identify the source of this image.

[2] Cross and Angelo (1988) and Light (1990) discuss the One Minute Paper.

[3] The Netscape form is only the latest incarnation of the One Minute Paper. Chizmar migrated from asking students to respond to the One Minute Paper first using paper and pencil and then using e-mail. The primary advantage of using the form is that it substantially reduces the analysis time—from over one hour to less than 15 minutes.

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Managing Networked Information

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ABSTRACT

Information aggregators such as campus information systems and community networks are becoming key navigational beacons in the electronic world, gathering information, both physically and logically, from a disparate set of sources and providers and integrating them into a coherent information space to users. Unfortunately, the operations of such services remains highly fragile and manual, limiting their scalability. This presentation will discuss some lessons learned in managing large-scale networked information and presents an emerging protocol that automates the critical steps in the provision of volatile on-line information.

PowerPoint presentation available,
see http://cause-www.colorado.edu/conference/cause95/c95track-6.html

The "Business" of Telecommunications

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ABSTRACT

Creating a balance between the delivery of telecommunications network services and fiscal responsibilities is a new challenge for telecom technocrats. We need to understand and communicate that the network cannot continue to provide current levels of performance while other functional areas, departments, and facilities within the institution are asked to reduce costs. Technology solutions must prove their value and rate of return. Telecommunications managers will be competing with everyone else for limited funds and resources. Managerial and marketing skills, COQ (cost of quality), cost avoidance, and other cost/productivity issues will be key issues in this paper.

Paper Not Available

THE CLASSROOM OF THE FUTURE

Dr. Raymond K. Neff
Vice President for Information Services
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ABSTRACT

This is a time of transition from blackboard and chalk and use of the overhead projector to the general-purpose projection system capable of handling all formats of digital and analog media and the classroom where there is a networked computer at each seat. Distance learning opportunities abound and are being explored, especially in the health science and engineering disciplines and professions where there are continuing education requirements. The ability to deliver credit-courses to homes and business locations represents a potentially significant revenue source for universities in the years to come. Our classrooms of the future must be designed to accommodate the widest range of distance learning situations. We now have the opportunity to link people and information resources in our region by using videoconferencing and video mail. Extending the classroom to wherever the student is located is the logical end of these early ventures. Information technology, properly developed, will produce the customized electronic learning environment we believe will be the hallmark of higher education in the twenty-first century.

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THE CLASSROOM OF THE FUTURE

Dr. Raymond K. Neff
Vice President for Information Services
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The classroom of the future is, as a matter of principle, wherever the student is. On campus, this means they are in traditional academic buildings, libraries, laboratories, the professor's office, and, last-but-not-least, the residence halls and fraternity/sorority houses. With the evolving global information infrastructure (a.k.a. information superhighway), we have the ultimate delivery vehicle for "distance education." At Case Western Reserve University, we have implemented a campus-wide 100% fiber optic network in all of our academic and residence buildings and are using it to prototype new instructional methods. This paper is a progress report on our designs for the classroom of the future and how we are presently using them.

The format of the classroom of today is based on a twelfth century model! It was the educational innovation of its time, and its time was when books were rare, and lecturers read from them to their class of students, who were basically copyists. Students did not take notes in class; they took a form of dictation. The shape of the lectern we use today reflects its original purpose which was to hold the larger, hand-copied book at a reasonable angle for reading to the class. The word lecturer, in fact, is derived from the Latin root infinitive "legere" meaning "to read." In Britain today, Lecturers (Latin root word) are called Readers (English root word). Thus, the foundation of the classroom of today is solidly in the middle ages.

As to other innovations, the blackboard, with slate and chalk, was introduced into higher education by way of engineering schools in the third decade of the nineteenth century. The electrified "Magic Lantern" slide projector entered the classroom during the last decade of the nineteenth century; movie projectors, photographic slide projectors, tape recorder/players, and phonograph players were introduced into classrooms during the early decades of the twentieth century, and the overhead projector, which many of our colleagues have still to master, came out of the bowling alley at the end of World War II. The computer was first used in the classroom by attaching time-sharing terminals to television sets, and this became a standard method of bringing the computer into the classroom by the late-1960's. By the mid-'70's large-screen projectors of computer displays had become practical, but these early systems for lecture-hall sized classes were frightfully expensive. By the mid-'90's, the evolution of information technology for the classroom has come far, and we have many cost-effective options from which to choose.

In this paper, we will show how to integrate many of these possibilities and bring full multimedia order from the seeming chaos. Our order comes from the singularly important transformation of all formats of classroom media from the analog domain to the uniform format of digital, binary-encoded data. Once information is transformed into the digital medium, it can then be displayed and manipulated with relative ease. Most significantly, digitally encoded information can be transmitted at very low cost, so that where the information is stored and where it is used can be widely dispersed. The implications of this for education are just now starting to be grasped by the education community.

The classroom of the future will likely be built in three different models:

The most common (model I) will be the simple extension of the familiar lecture hall with the use of large-screen projection as the output display from a multimedia computer and the lectern being augmented with digital controllers. Model II will put a personal microcomputer system at each student's seat; and model III will involve linking the instructor to remotely located students using an extension of a video-teleconferencing system. In any particular situation, one can have a mixture of these different models, so that the most prevalent version of the classroom of the future is likely to be a hybrid of all three models. At Case Western Reserve University, we are using several classrooms which have the functionalities implied by these models; we have also built versions which are hybrids of models I and III.

General-purpose projection systems

Modern classroom projection systems have evolved to a point where they can provide high resolution viewing such that students can see demonstrations and other "effects" better than they ever could in the "classroom of the past." When these projectors are attached to a high-speed digital network, a remotely located student and the teacher can be linked together as effectively as if they were in the same room. This is especially relevant in considering computer-oriented multimedia, because in many respects, the workstations of tomorrow will combine high-quality video display screens with the ability to process the multimedia information in just the ways we want it, customized to the time and the purpose of the particular learning situation.

At CWRU, we have adopted a standard of two high-resolution projectors per classroom. Each may have an independent or common video source. Why two? With today's display technologies having roughly 0.8 - 1.3 million pixels, there simply are not enough pixels of information with one display. With two, it is easier to use teaching methods which feature the paradigms of compare-and-contrast, before-and-after, type A-versus-type B, etc. A common occurrence in classrooms so equipped is to use one projector to hold the outline for the class session and the second to work through the details, whether using the computer, video or photographic sources; another scenario uses one projector to display the professor's class notes and the other to display computer simulations. Interestingly, with two projectors, our experience is that the use of the blackboard is much reduced.

Our projectors are general purpose and can handle a wide variety of media sources, including computer display output (ranging from ordinary personal computers to the highest performance workstations), carousel-type-35mm photographic slides, videotape/videodisc, 16mm movies, broadcast/cable television (using NTSC signaling). One important peripheral used with the projector is a desk-top document video camera; such a combination of devices duplicates all of the functionality of an overhead projector and replaces the use of acetate foils and grease pencils with ordinary pencil/pen and paper. If the document camera handles color, then the projected images reflect that. The principal advantage of this arrangement is in a distance education setting where remote students can readily see the transmitted images from the document camera which otherwise might be difficult to make out when using a wider-angle television camera suitable for viewing the instructor and/or the class itself. It is worth noting that we use projectors which can accommodate both NTSC (the standard for North American television) and RGB (red-green-blue) signaling. As configured at CWRU, the dual projection system is coupled to a dual stereo sound system to generate high-quality audio information in the classroom. This sound system is balanced so that when both projectors are employed, the dual stereo systems do not interfere with one another.

It is our experience that the use of even one computer projector in the classroom can cause the instructor to divert his/her attention from the students and be drawn to the screen display. The loss of eye contact with the students can reduce the effectiveness of the learning experience. To remedy this problem, we have installed a high-quality video monitor in the podium, so that the instructor can switch between the projected image and the students with simple eye movements. This has proven to be a satisfactory solution, and so we have replicated it for both projectors in a classroom.

Mobile computers

At Case Western Reserve University, we have developed a concept where the student and the professor both bring their portable computers to class. (They also take them to the library and to laboratories and use them in their residence halls.) Because connectivity with the campus network is so important, each student's desk, wherever the student may work, is equipped with a network information outlet which "docks" with the mobile computer. The newly developed PCMCIAinterface adapter card for Ethernet networking is one cost-effective way to connect a high-speed network to a portable computer by using a microcomputer interface now becoming standard for this type of machine. Thus, each student is fully "informated" as s/he participates in any type of classroom-based learning. When a computer projection system is integrated with these multiple computers, each person can contribute to the class by showing whatever information is pertinent. The computer can realize its potential power to illuminate a point of discussion by tapping into electronic libraries worldwide. It can also serve to demonstrate a relationship, simulate an event or process, or simply be an efficient note taker and organizer. With so much potential, it is not possible to catalog all the possibilities here.

For undergraduate students, our campus features a residential living style.

The computer and the network are right at home in our residence halls and fraternity/sorority houses. This is because we put a network outlet at every student's desk. Now with 92% of these students having a computer on the network (computer ownership at CWRU is voluntary, but highly recommended), the virtual classroom is open for learning 24 hours per day. Access to faculty has also increased because the students use the network to contact faculty when they encounter a stumbling block. Faculty and students now work together more synchronously.

The network currently brings our students a wide range of computer-based information resources from various electronic libraries, permits a variety of person-to-person exchanges (e-mail, voice mail, and video mail), and provides some 39 channels of television, including 24 "educational" and 15 "entertainment" channels. To give just a few examples: For students learning a foreign language, there are both "passive" media like the evening news in Russian from the SCOLA channel or "active" media like conversing with another student in Japanese at Waseda University (Tokyo) over the Internet. In our virtual physics laboratories (we have real ones, too), students can perform thousands of experiments in a mere afternoon. To eliminate drudgery, data acquisition is automatically displayed in graphical formats. Students like this electronic learning environment where relationships among phenomena can be discovered and explored.

Diversity in computer configurations

One of the most common problems in equipping a classroom with a computer is in designing the particular computer configurations to be supported. To simplify this just a bit, we have three basically heterogeneous types of computers: those based on Intel processors, those based on the Macintosh Operating System, and those based on some "flavor" of UNIX. Should each classroom support all three? At another level of detail, what should each specific hardware configuration be? What speed for the processor? How much RAM? Hard disk capacity? Local CD-ROM? etc. The number of possible configurations is daunting, and implementing the ultimate configuration for each feature is ruinously expensive. There has to be a better way.

Another family of problems has to do with the instructor's initialization of the classroom-based computer system. If the computer is permanently installed in the classroom, then at the end of one class, the instructor for the next has to initialize the computer, and often, this takes more time than what is allotted between classes, and the problems do not stop there. Even if the software can be copied and made operational in this period, there may still be a latent problem because the classroom system may not match the configuration which the software requires, and it may not be until the software is used that this problem becomes known. Clearly, this "can of worms" can be both messy and embarrassing to the instructor. There has to be a better way.

At CWRU, we have been using a model where computer use does not require that there actually be a computer in the classroom! We use the standard classroom dual projection system, as described above, together with the computer in the professor's own office and connect them over the campus network. In this way, we solve both the equipment diversity problem (by using the professor's computer which is properly configured to run the appropriate software) and the initialization problem (since before the scheduled class the professor can allocate sufficient time to set up and rehearse the planned computer usage). The "trick" for our solution is in how to control the remote computer from the classroom. Our approach uses the keyboard and mouse-pointer as input devices attached to the network in the classroom and the appropriately configured computer with fully operational software network-attached in the professor's office. A centrally located (and operated) analog video/audio switch connects the (digital) computer network to the classroom display systems (both projectors and the instructor's podium monitors, as well as the audio subsystems) using the fiber optic cabling in the campus network. There are also economic implications of this solution because as described herein, each classroom does not need to be equipped with a set of high-end computers. There is the cost of the central analog video/audio switch but this is easily justified by the cost savings for the computers themselves when considering it as a campus-wide solution and investment. It is interesting to note that with the newly emerging network hardware standard called ATM (Asynchronous Transfer Mode), it will be possible to eliminate the analog switch entirely; the ATM switch will take its place in the purely digital domain. It will be necessary however to return the signal to the analog mode when attaching to the classroom's projectors and video monitors. Because the campus-wide network is key to the evolution of the classroom, we will next take up some of the most important elements of the network and its hardware and software infrastructure.

The campus-wide network infrastructure

The classroom of the future does not sit in isolation; it depends critically on the campus-wide network and its extensions into the regional and global telecommunications grids. Earlier we saw that the campus-based network provided a very useful service in connecting separated components of a single computer system. We also will use the network to connect people who are separated by distance, particularly the teacher and his/her students.

At Case Western Reserve University, we are using our campus-wide network to provide multi-site videoconferencing which extends the classroom beyond the bounds of a single building and even the campus itself. (By the term multi-site videoconferencing, we mean connecting two or more locations using video/audio and computer signaling to form a virtual meeting, on-campus or off.) But why is this necessary? At CWRU, we believe that our educational mission can be better fulfilled by bringing our classroom to students who live and work at a distance from the campus. For post-baccalaureate programs, this type of educational experience can be especially productive. We are currently using it in several professional school programs, including engineering, social work, nursing, and medicine.

Consider a situation in which students are assigned to a learning environment located at a distance from the guidance of the advisor/teacher.

Medical students and nurses in hospital-based training programs is just one possible instance in which a videoconferencing system can meet the need to conquer the distance from the campus. For some master's-level engineering students, the distance learning network reduces their travel costs and both the effort and time commitments necessary to sustaining a meaningful educational experience.

Key to extending the network beyond the campus is the emergence of a new type of communications technology called ATM. All of the major national and virtually all of the international telecommunications carriers have committed to this new technology. At CWRU, we are evolving our internal network to ATM, so that it will be able to interdigitate seamlessly with the ATM networks of these common carriers for full multimedia, digital information exchange. Because ATM offers the capability of merging video/audio with computer-based data in a flexible multimedia package, we will eventually have an integration of information formats which facilitates education. Because, in the future, we will transmit and receive video information in the digital domain, we will be able to offer other varieties of computer-based information, especially from digital libraries, to augment the virtual classroom. As we envision it now, the additional information can be placed in another window on the same display device as the video conference. A simple extension of this idea occurs when we want to link students in work groups. Because our campus' residence hall rooms are all wired for video and data, as well as for telephone, we can marry a video camera to a computer and originate multi-site videoconferences among a set of students' rooms. Use of a video mail feature will provide a record of what has occurred, so that a team member who was absent from the virtual meeting will not have missed out entirely.

In graduate-level professional education, we see the importance of using the extensions of the campus network to bring the university and its information environment to the offices and laboratories where our students and faculty interact in their training. By using the same advanced communications technologies of ATM and SONET (Synchronous Optical NETworking), which our telephone and television vendors will be using, the university will facilitate the extensions of the network to off-campus locations, including hospitals, clinics, physicians' and dentists' offices, law offices, social work agencies, and governmental agencies.

By combining the distinct technologies of personal computers, digital television, electronic libraries, and videoconferencing, the classroom of the future will take advantage of multimedia information from campus-based servers as transmitted over advanced ATM network-based delivery systems to desk-top learning stations. Upon this technology base, it will be possible for the university of tomorrow to offer a form of time-shifted learning, i.e., providing learning opportunities to students which they can use at their own convenience. Time-shifted learning has the advantage of breaking up the rigidity of scheduled classes which universities may find increasingly limiting in meeting the needs of their non-traditional students. Time-shifted learning will clearly be useful in continuing education programs, as well. This type of system will expand our community of potential students by providing more options for meeting their multiple needs. Readily available information and increasing the access to it are part of the information technology infrastructure we are developing.

Another significant aspect of the new learning modalities is the built-in capability of replaying a learning segment. We know well that all students do not learn at the same pace, and that they relate new information to that which they already know. Since these students have different experience bases upon which their newly acquired information is to be integrated, they will not be incorporating it in the same way. Being able to replay and to learn a new subject at the depth appropriate to the purpose of the user will give the student a capability far beyond what s/he is offered in the classroom of today in our "one-size-fits-all" formats for presenting information. The logical extension of this idea is to use information technology to deliver customized instruction. The validity of this concept is based on the differential "inputs" of prior experience each student brings to the learning situation and on the increasingly important learning goal of attaining differentiated levels of achievement as "outputs."

It has been our experience at CWRU that students learn better with computers because, with computers, learning is more likely to seem like fun! Students spend more time "on task" when using a network-based computer, and as a result, they get better grades and flunk out less. Use of the computer seems to have the potential of offering more success at the college level, which for us is the real meat of the "six-sigma" total quality management philosophy.

Extending the classroom to wherever the student is located is the logical end of these early ventures. Information technology, properly developed, will produce the customized electronic learning environment we believe will be the hallmark of higher education in the twenty-first century.

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TRACK 7
PROFESSIONAL DEVELOPMENT

Coordinator: Vijay Kumar

Developing as Information Technology Professionals: Profiles and Practices

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Abstract: IT professionals are too often narrowly defined by their particular expertise, even by the specific technologies with which they work. This categorization presents problems for managers responsible for integrating a broad array of IT staff into a cohesive unit with common missions and goals. It can also create severe obstacles for the professional development of individuals within IT organizations. This paper identifies four characteristics of the IT professional that generalize across platforms and technical expertise: customer orientation, creativity, collaboration, and communication. Implications of these characteristics for organizing work, for staff evaluation, and for professional development are outlined. A case study examines the particular challenges of infusing digital technologies into traditional technology support services, such as those provided by AV professionals.

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Introduction

In the last decade, technologies supporting all aspects of higher education have proliferated, the number of technology users on campus has vastly increased, and their expectations have soared. Campus computing organizations have scrambled to keep up, in a rapidly evolving, centrifugal process that has spun our organizations and our staff further and further afield -- physically, technically, and psychologically -- as we attempt to balance service and innovation, to support the newest technology without abandoning the oldest, and to add or develop the needed expertise among our staff. This outward, centrifugal motion has created collisions with other organizations on campus that also acquire and deliver information -- the libraries, the AV departments, the television stations, to name a few. These collisions have sometimes been painful and confusing, sometimes liberating and creative.

For us as IT managers, this centrifugal motion within our own organizations, as well as the resulting collisions with other groups, creates many challenges. In this paper we focus on the particular challenge of enhancing the development of our professional staff members in this fluid and rapidly changing context.

We begin with the observation that professional staff are too often narrowly defined by their particular expertise, or even more narrowly by the specific technologies with which they work: we can easily identify "the UNIX gurus" for instance, and it's not hard to tell the AV technicians (the Old Media experts) from the New Media center staff, or the reference desk librarians from the computing center Help Desk professionals. They each have a unique vocabulary, a unique vantage point within the institution, and sometimes unique dress and work habits.

The specialized expertise of these diverse professionals seems necessary to provide first-rate customer service. But a narrow emphasis on specialized expertise as the primary characteristic of the IT professional can hobble the IT organization, making it difficult both for individuals to grow professionally and for the organization to respond quickly and with a clear sense of its mission as technologies evolve and customer needs increase and change. Furthermore, this emphasis on specialized expertise has led to subtle, technology-based class distinctions among IT professionals, with the result that as technologies merge, productive synergy between groups can be unnecessarily hard to generate. Where groups on collision course have been asked to cooperate or even merge, these distinctions have made collaboration difficult.

In an environment of endless technological change, continuing technical education for professional staff is important and necessary. But simply piling one training program on top of another does not constitute good professional development practice. Instead, IT managers need to counteract the centrifugal tendency with a converging, centripetal strategy that centers goals for staff development and performance on characteristics that generalize across particular technologies and expertise. The fact that previously distinct technologies are rapidly merging provides impetus for developing such a strategy, as services must be redesigned and yesterday's special expertise becomes obsolete or has value in a new context.

The professional staff members within an IT organization today can range from the UNIX-savvy Webmaster to the slide projectionist, from the presentation graphics assistant to the interactive graphics programmer, from the expert in audio systems for classrooms to the expert in database design. The profile described below attempts to enumerate and illustrate the common characteristics of these diverse professionals. The goal in developing this common profile is to help both staff members and managers understand the "expertise" of IT professionals as a broad set of skills that encompass much more than technical know-how. From this understanding can come better strategies for developing professional staff members and assessing their performance. This profile also provides the basis for establishing a common set of professional goals that will help staff members understand how they can work productively as a unit, and even interact more effectively with IT professionals in other groups and units.

Profile of an IT Professional

The profile of the IT professional includes these four primary characteristics:

- Customer-orientation
- Creativity
- Collaboration
- Communication

We will look first at each aspect of this profile in more detail, and then we will look at the ways this profile illuminates a case study in team-building, including specific practices, problems, and progress.

1. Customer orientation

Putting customers first is not a new idea, nor one that uniquely characterizes the IT professional: it is a primary quality of any member of a service organization. Each member of the IT staff, whether or not he or she deals directly with campus customers, should be expected to put the needs of campus technology users first. To serve customers effectively, IT staff need to:

* know what their customers need to do their work;
* serve the institutional mission as it is interpreted and implemented by those customers;
* focus on providing services "just in time" for a community that is incredibly driven by the time constraints of the academic year;
* foster independent use of technologies by customers.

Strong customer orientation integrates both the IT staff member and the IT organization into the routine processes of the academic institution, and can be a source of great professional satisfaction. But providing consistent and thorough customer service is a great professional challenge in an environment constantly in flux.

2. Creativity

The focus on customer orientation establishes the service component of the IT professional. Adding the second characteristic, creativity, affirms the simultaneous role of IT professionals as innovators, as leaders in the development and introduction of new technologies on campus. This element in the profile of the IT professional also needs to be articulated for every member of the staff, even those whose jobs seem most dedicated to delivery of quotidian services. This creativity, however, needs to be nurtured and exercised in the context of the institution's mission and available resources. For the IT professional, creative activity includes the ability to:

* anticipate customer needs;
* master appropriate technical skills, and teach or share new abilities with colleagues;
* identify and pursue innovative projects that generalize across broad segments of the institution and that fit the institution's mission;
* take a successful project and turn it into a service;
* extend a routine solution or a general purpose tool imaginatively to solve new problems in a cost or time effective way.

The exercise of creative talent is a powerful springboard for professional growth and infuses new energy into the IT organization. Innovative achievements inspire others, create new standards of excellence, and provide new options for customers. The challenge for managers is often how to nurture creativity in environments where resources are scarce and risks are seldom encouraged.

3. Collaboration

IT organizations and IT staff cannot operate successfully in isolation, and should not try to do so. We can no longer inhabit the silicon basements on campus, performing our wizardry darkly, even if benignly, on behalf of others. We must be out in the fray, perceived as valued partners of staff, of faculty, and even of students. Collaborations leverage those scarce resources. Collaborations also provide both insight that drives the establishment of new customer services and fresh ideas that spur further creativity and innovation. IT professionals need to build collaborative relationships in every forum. They should be encouraged to do so with all of the following groups:

- with customers;
- with colleagues within their own organization;
- with other campus groups and offices;
- with colleagues on other campuses and in professional organizations;
- with vendors and other external groups.

Good collaboration builds teams that provide the IT professional with new knowledge, new models, and new perspectives. Collaborations offer the opportunity for valuable critique, for unexpected innovation, for the chance to share expertise and develop new skills. Collaborative activities can also be excruciatingly time consuming. Unless carefully managed, the processes involved in collaboration can overwhelm the goal, and frustrate staff rather than reward their efforts.

4. Communication

IT organizations usually maintain and develop the major communications media on campus, and so it is ironic that IT organizations and their staff members often fail to communicate effectively with one another and with their customers. The ability to communicate is critical to the success of the IT professional as an individual and as a member of the IT team. Communication includes a commitment both to listening -- assimilating everything that comes in from customers, from collaborations, and to sharing -- querying, responding, and informing, in a timely and graceful manner. The IT professional must be able to:

- listen to the customers;
- absorb and interpret institutional and national "messages";
- understand that the knowledge of the IT professional is not arcane or privileged, but should be shared in language that customers and colleagues can understand;
- provide IT services that are visible, accessible, convenient, and well-documented;
- see communication as a mutual process of timely teaching and learning.

Effective communication provides an essential flow of information within the IT organization as well as between IT staff and customers. But effective communication is hard to achieve. It requires both unusual honesty and great empathy. And it also requires technically adept staff members to relinquish their traditional posture as the expert and assume a new role as guide, colleague, and coach.

A profile of the IT professional that focuses on these general characteristics rather than on a particular technical expertise is useful for:

* articulating individual job responsibilities;
* providing specific goals for the professional development of individual staff members;
* evaluating professional performance and professional growth;
* establishing goals and priorities for the IT organization, so that the goals for individual staff members are given a supportive context;
* defining milestones for the IT organization's progress;
* building organizational unity and improving staff morale with a sense of shared vision and shared practice;
* finally, telling an organization's story, and analyzing its progress, by looking at some of the ways these professional characteristics have infused the processes of planning and implementation.

For an example of such an analysis, we turn to a case study of transformation and professional development in the Educational Technologies division of the University of California at Los Angeles.

A Case Study: Media/IT Professionals

First some background: In 1993, media services at the Office of Instructional Development (OID) at UCLA was a collective term used to refer to the various technology-based service units. Each with its own manager, who temporarily reported to the Director, the units had at various times in their existence reported to different levels of management (including different organizations) in a variety of combinations. Following an external review, the recommendation was accepted to organize these functional areas into one "Educational Technologies" division within OID.

On paper, therefore, the following functional areas were quickly merged:

* Audio Visual Services
* Instructional Media Production
* Media Systems Design
* Media Systems Maintenance
* Language Lab, Media Lab, Media Library, Teleconferencing & Satellite Services
* Photography & Graphic Services

And, a few months later, a new Assistant Director was hired to create a cohesive set of services, to integrate digital technologies into the service spectrum, to improve the quality of service, and to bring the units into fiscal soundness. Within the first year, two of the units (Design & Maintenance) were merged under a single manager and a new unit, Information Technology Systems, was added to the division.

The managers, most of whom had worked for the organization for more than 10 years (two for more than 20 years) were senior professionals in their area of media and service delivery. Although there were some unit interdependencies and opportunities for collaboration on a project basis, there had been no recent attempts nor programmatic design to exploit overlaps for either professional growth or service improvement and expansion. The managers viewed themselves first as media professionals with distinct areas of expertise (for example, a producer/director) and secondly as a manager. The professional development, therefore, had to include both the expansion from media to instructional technologies and from operational supervision to managerial functions, such as program, service, and fiscal planing. Similarly, for members of these units, along with learning new technologies and how to integrate and deploy them, came the new imperative to think broadly across unit boundaries so that intersection of services was seamless for the client.

Adding information technologies brought a new set of customers and a new set of expectations which had either been non existent in the traditional media services, or were only present in a very small percentage of the customer base -- primarily those for whom the media was also central to their academic expertise. We have grouped these changes in customer expectation around four topics which we then use to illustrate the IT profile with the IT practice:

* Pervasive access: once aware of even some of the potential uses of IT, the customer quickly expects to find equally predictable accessibility in multiple, if not all, locations in which they need to perform their work. For example, whereas a faculty member may have been quite satisfied with (or at least willing to accept) having a film or video projector in only specialized locations, they rapidly came to expect predictable accessibility to hardware, software, and information in their offices, in classrooms, in labs, in dorms, in residences, etc. This expectation has also extended back to the traditional media equipment, such as overhead and slide projectors, which customers also now expect to find in every teaching location.

* Independent use: faculty, staff, and students were quite satisfied with (or at least willing to accept) the process of working through the media professional, whether to create, adapt or use media in traditional formats. In contrast, after only a modest amount of experience with IT, customers expect to be able to create their own materials, to function independently of an "expert", indeed, to become experts in their own right.

* Frequent change: faculty, staff, and students were quite satisfied with (or at least willing to accept) changes in the medium and projection equipment or film, video, slides; changes were incremental, occurred after many years and often had little or no impact on their own possessions, finances, or ability to incorporate content into teaching and learning. In contrast, changes in digital technologies impact faculty, staff, and students daily - whether potentially or in fact.

* Extensive choice: faculty, staff, and students were quite satisfied with (or at least willing to accept) the choices media professionals made for them or recommended to them. The variety of choices were fewer, their differences clearer, and the implications were fairly predictable. In contrast, the mix and match choices of IT (euphemistically captured in the "plug and play" phrase) seem infinite, the meaningful differences usually unknown, and the ramifications unpredictable, given the expectations for pervasive access, independent use, and frequent change . Right choices are less obvious -- maybe impossible, except for the briefest of time periods.

The Profile in Practice

The first step we took was to lay the groundwork for the division by writing a vision statement on which we could build a common set of goals for service and services. This vision statement focused on the client and the instructional mission of the larger organization; it made no mention of units.

Customer Orientation:

We have found that the customer orientation has had to increase, building on what was present and expected as media professionals, to include the ability to:

* serve a new customer base for whom media is IT while helping customers somewhat "stuck" in old forms of media to broaden their horizons;
* respond effectively to immediate service requests within the technological and programmatic context of the customer;
* maintain incredibly rapid and flexible adaptation of services while integrating a broader range of technology options;
* achieve professional growth and satisfaction through creating information and opportunities which enable the customer to work and learn independently.

Some things never change, they just increase. Both with media and with IT, engaging customers in the development process is the key to doing the right thing in the right way. For example, we started with the goal of helping faculty use IT in the classroom. Working with faculty "pilots", local support staff and various central services, we are now connecting classrooms to the backbone, providing laptops via audio-visual services, supporting the creation and adaptation of materials, and developing production-level digital imaging services.

Creativity:

Overall, we have learned that adapting existing media services and developing new IT services happens more rapidly, must integrate a broader range of physical and technological options, and most certainly will end up incorporating several unexpected service outcomes. The fact that these media service units and professionals had a long established focus on supporting innovation in teaching made it possible to move more rapidly to develop long and short-term goals and begin implementing projects across unit boundaries.

Practice has shown us that our media/IT professionals must continually pursue:

* understanding major technology changes and how the campus is intending to or should integrate them; for example, our media systems design unit is currently testing options for delivering interactive video to the classrooms over ATM;
* mastering new technical skills, while "letting go" of the need to be THE expert and developing a readiness to share the role of trainer/consultant with both other IT professionals and customers with expertise;
* adapting or building on the ideas and work of others (including those of the customer) to create new access, new opportunities, new solutions.

An example of how a trend in one area can be applied to another is evident in our experience with fostering independent use. We found that the faculty's expectations to use computing independently may have enabled audio-visual services to help faculty learn to use almost all projection equipment independently. Not only has this resulted in an enormous savings in operational costs, it has also enabled an increased number of faculty to use media and technology in teaching.

Collaboration:

Organizationally, we elected NOT to create a "new media" unit while leaving the traditional media services unchanged. Instead, we infused changes horizontally across all units. For example, instructional media production also now provides consultation and fee-based services for the production of interactive multimedia. We also created an internal technology systems group to help us define technology standards, develop a technology infrastructure, support staff use of systems and networks, and plan pilot projects with the units.

When IT pervades services, we have found that there is almost never a time when, as media/IT professionals, we don't need to:

* talk with departments to understand what their technology and services plans are, where the hot spots are, and what plans are under discussion;
* connect with technology vendors and consortia to ensure that we know the big picture at least as soon as our customers do and invite them to become part of our innovations;
* work with peers and customers at other institutions to develop solutions (for their customers or our own) which enable collaboration among customers and sharing of resources.

An excellent example of such qualities in practice has been evident in the development of a center for faculty to experiment with digital technologies. It was created in consultation with faculty, departmental support staff, vendors, and other higher education institutions. In the operations, we find ourselves working with (on our campus as well as on other campuses) faculty, librarians, technology and media vendors, and publishers (to name but a few) while pulling in expertise and resources from across our own units, the campus and remote institutions.

Communication:

The new media/IT professional recognizes that they are part of a community of supporters, sometimes the expert, often the learner, ideally a peer - with information to share and understanding to gain. Given the imperatives of customer orientation, creativity and collaboration, we have found that information now is critical to the operation of a broader set of services, impacting an unknown number of customers, over a wider geographic area.

We have learned that the IT professional must be able to:

* share expertise or their services will flounder, their colleagues may fail, and their customers will surely go it alone or look elsewhere;
* provide chunks of accessible (both technologically and contextually) information which can be integrated on the fly to solve an immediate problem;
* meet the "just in time" approach of customers to look for answers when they need them and not when the expert is ready to publish them.

We have learned that the best way to grow expertise as an IT professional is to give away what you know so that others can use it and work effectively without you. The benefits are as important for the professional, who can move on to something new, as for the information consumer who is able to work more readily at their own pace.

Conclusion

We are now well launched into the third phase of expanding what were pilot projects to production services in every facet of our operations and services. For example: digital imaging services in Photography, a faculty new media center in Instructional Media Production, desktop videoconference in distance learning services, multimedia delivery systems in the media lab and multimedia resources in the library. We are currently designing interactive video capabilities for classrooms, a multimedia development lab for students, a multimedia teaching lab to replace the aging language lab and a much expanded digital innovation center for faculty. Not one of these projects and services would have been accomplished without the collaboration and newly developed expertise of staff in multiple units, both within OID and on the campus.

Some measures of progress and success are already visible:

* fiscal soundness of the units as a result of streamlined services (including the phasing out or redefining of several), new services with revenue streams, and increased productivity;
* customer view of services has continued to improve on OID's previous fine reputation as a result of responding to outcomes of focused service evaluations and continual dialogues with faculty at every possible opportunity;
* involvement (as both initiators and collaborators) in key projects at both departmental and campus-wide levels with a broad range of customers and professional peers;
* support of key opinion and decision makers who have come to rely on the quality of the expertise and service;
* involvement of vendors as a result of increased visibility from services which are valued by individual customers and by the institution.

The rewards for the media/IT professionals are tightly connected to these milestones of progress and success:

* breadth and depth of expertise is increasing significantly;
* opportunities to be closely involved with new technology assessment and service integration;
* reputation and respect for quality service and professional expertise;
* opinions are solicited and collaboration is requested.

Phase three is, for better or worse, the phase which never ends. As experienced media/IT professionals, we will continue to improve our abilities to:

* understand the mission of the institution and the continual changes in progress to fulfill that mission
* listen to customers as they experiment with technology in teaching
* collaborate with a broader than ever group of peers and customers to provide an environment full of customized solutions
* contribute high-value information
* innovate, innovate, innovate.

Developing and Maintaining a World-Class IT Staff

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The shift of organizations from management-focused to team-focused and operated necessitates a vigilance in developing individual professional development plans for employees, particularly in the IT profession.

The trappings of success--a position in management, a corner office, and a long title--have been replaced by coordinated, project-focused work teams comprised of the organization's experts. This new environment leaves employees questioning their value, if not their roles, in the organizational structure. Without the common measurements of success, employees struggle to identify their contribution to the organization.

Skills assessment and professional development planning are essential to developing world-class employees for a world-class organization. The skills matrix that will be presented will help to identify the strengths and weaknesses of your current IT staff as well as provide a template for the makings of the ideal IT department. The matrix also serves as the cornerstone for individual professional development plans focused on ensuring each employee's value and contribution to the organization.

Developing and Maintaining a World-Class IT Staff

The twenty-first century ushers in with it a new way of looking at professionalism. In a world where cubicles have replaced corner offices and titles are often omitted from business cards to make room for an Internet address, how is the average employee supposed to know she's *made* it? The trappings of success, particularly in the higher education environment where the average computer center is seated several feet below street level, are evaporating. Traditional measures of success are being cast aside in favor of more subtle rewards which come with making a measurable contribution to the organization.

The problem in this paradigm adjustment is that nobody is telling employees about the change in the measurements of success, nor are they communicating the employee's relative value to the organization. Helping employees measure their personal success in this new environment requires an emphasis on the new measures of success--team orientation, coordination, contribution, and expertise. As a manager, articulating the role of each employee in the organization and shaping the future of each employee is a challenge; it is, however, the hallmark of superior management.

Drawing on information from a multitude of sources outlined in the bibliography which follows this article, as well as from personal experiences at Datatel, the development of a skills matrix is recommended as the first step toward developing a world-class IT staff. The skills matrix serves as the cornerstone of workforce planning and retention.

Developing a Skills Matrix

Assessing individual competencies is an essential component in the development and retention of staff, particularly in view of the employee's need to be reassured of their value in the new organizational paradigm. "...many companies are beginning to define for employees what it takes to move to the next level by defining key behaviors, or competencies, need in their work force," according to the May 1995, *Personnel Journal*.

A skills matrix is a simple tool to allow you to assess the skill sets on your team. Begin by developing a foundational matrix which outlines the skills required for the organizational unit as a whole. Be certain to cover the most basic skills that are required in your department, including telephone skills, problem solving, written communication, multi-tasking. Identify those items which are an essential requirement for all departmental employees.

When the foundational items are complete begin to develop a list of the more specialized skills required to meet departmental obligations. Think beyond your current staff. In fact, the matrix will be most valuable if you develop the skills list with a vision of what will be necessary to meet departmental needs three to five years from now. It may be that you have no one who has these skills today. The purpose of the matrix is to provide an eye to the future as well as a planning and development tool for today.

Once you have completed the complete list of skills, assign a weight to each item. Because of the broad mix of skills that any one individual may possess, it is difficult to assign weighting factors which total to 100 percent. Use scales of 1 to 5 or 1 to 100 percent for each skill. When loaded into a spreadsheet program, these weights will be multiplied against the respondent's answers and when totaled provide an overall score for the respondent.

Weights should be assigned to each skill by the manager prior to an employee completing the matrix. Weights should be the same regardless of the employee completing the matrix. The purpose of the matrix is to provide you with a view of the ideal staff, as well as a discussion point for developing a professional development plan for each employee. Weights should be kept off the employee's skills matrix instrument, so as not to bias employee responses.

While the employees are completing their individual assessments, the manager should be completing a departmental assessment and vision matrix. The manager should assess the current demands of the organization for IT support and outline on the matrix the level of and intensity of skill required to meet the demand today and three years from now. The projections on the manager's matrix will provide a benchmark for recruiting and hiring staff.

A spreadsheet application is ideal for data storage and manipulation of the skills matrix data. Session attendees will receive a sample of a spreadsheet matrix.

Each employee's matrix should be weighted and scored providing the manager with a snapshot of the core competencies of the individual from employee's perspective. You will be amazed at the skills that will be uncovered through this process. Employees that you have filling a narrow role often have developed skills which would transfer to other departmental functions.

The individual skills assessments should be plotted with the managers vision matrix on one spreadsheet and totaled. This will provide individual reference points as well as an overall view of what it will take to develop a world-class IT staff.

Developing Individuals

Using the individual skills matrix responses, the manager should meet with each employee and review the responses. Together they can begin developing a professional development plan for the employee which meets their mutual objectives. The matrix provides a less personal entree into sometimes difficult discussions regarding the employee's position within the organization, as well as provides an opportunity for the manager to layout his vision for the employee over the next three to five years.

The review of the skills matrix is only the first step to achieving productive and happy employees. Regular, personal communication is critical to keep the employee focused and to reinforce the employee's value to the organization. At Datatel we use an instrument called a 90/90 review to stay focused on departmental goals and employee development. The 90/90 review was developed by Datatel manager Ron Tucker for use in managing Datatel's operations (or IT) department.

The 90/90 review is based on the philosophy that a manager should spend at least 90 minutes every 90 days working individually with employees. As the included sample review form illustrates, the 90 minutes of discussion is focused on the employee's accomplishments over the last 90 days, the development of goals for the next 90 days, and a review of professional development milestones and specific plans for action. Most Datatel employees enjoy the "no surprises" approach to the review process. Keeping in contact keeps everyone focused.

Developing a Departmental Plan

The skills matrix provides the data essential for the manager to prepare for the IT department of the year 2000. With a quantifiable view of how close or far you are from reaching your world-class view, you can develop specific strategies to bridge the gaps that were highlighted by the matrix. The data is also effective in justifying new staff in times of limited hiring, and threatened downsizing. The manager who can articulate the gaps in expertise and who can pair these gaps with the institution's requirements will be successful in attempts to build a world-class IT department.

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After IT Restructuring: What's Next?

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After IT Restructuring: What's Next?

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I. Introduction

In July 1993, DePaul University integrated its information technology and services functions under a new information technology division. This restructuring consolidated formerly fragmented services to achieve a unified direction for information technology aligned with university goals. In two years, the new division brought the university into a competitive technology environment of integrated network infrastructure and client server architecture. To respond to changing technology environment and maturing user community, in spring 1995, the division undertook a second restructuring effort. Four strategies were used to reposition the division: a) streamline functional areas for greater coordination; b) invigorate team leadership for shared responsibilities; c) initiate new cross-functional processes to enhance IT effectiveness; and d) implement a comprehensive communication and customer service program to forge active partnership with users.

This paper examines DePaul's experience after its initial IT restructuring and discusses the rationales and strategies for further changes to meet changing university needs. Two cases, network and client server support, are presented to illustrate the strategies and implications.

II. Phase One: Building Technology and Organization Infrastructure

My recent article on "Strategies for Restructuring IT Organizations" (Chan, 1995) provides a fairly detailed discussion of DePaul's first effort in restructuring its IT functions. In essence, five principles have guided the IT restructuring:

- focus on institutional strategic goals
- maintain IT organizational responsiveness;
- provide integrated information and technology solutions;
- develop an IT culture of learning organizations; and
- insist on flexibility in resource management.

The new division adopted a team-based, horizontal structure to achieve a unified vision, shared values, responsiveness to institutional change, and improved productivity. Seven small and flat functional groups were formed to replace formerly large, hierarchical, and separated departments.

1. Outcomes and Deliverables

This restructuring yielded many positive outcomes:

- networked 2500 users at five campuses
- standards for platforms, productivity tools, hardware, and network operating systems
- standards for client server environment
- a five-year telecommunications plan
- a new telephone switch for the Lincoln Park Campus
- consolidation of academic computing operating systems
- student and faculty microcomputing centers
- residence hall data & voice cabling
- enterprise data model for new student systems

- mainframe operating systems migration
- data gateway for client servers
- reengineered fund-raising process

2. Key Strategies

Core Values for IT Organization. Ten core values were introduced to unify formerly separated cultures and organizations. These values were incorporated into a new performance appraisal system as performance attributes: commitment to mission, continuous quality improvement, creativity and innovation, customer focus, leadership, openness to change, result-oriented, self-directed learning, self-empowerment, and teamwork and collaboration. These values helped to redirect staff's attention to the need for change, but have limited effect if not continuously translated into performance expectation.

High Performance Management. A new performance appraisal system helped to set performance objectives and review outcomes every six months. These objectives are linked to university and divisional strategies. This process motivated managers and staff to think and behave in measurable goals.

Cross-Functional Teams. We created cross-functional teams to support help desk, computing workshops, computing labs, and special projects. Team approach for ongoing support was less satisfactory than that for projects. Users were confused with the process approach. Clear objectives, outcome expectation, and division of labor are essential for team success. As a new organization, we underestimated the training requirement.

Reskilling of IT Staff. Multiple strategies were used to develop the soft and technical skills of IT staff across division. Leadership development programs, technical training on new technology for targeted individuals, participation in special projects, coupled with rigorous performance management, yielded high performance and productivity.

Partnership with Clients. Despite our effort in communication, the massive and numerous technology changes introduced in the past two years heightened users' anxiety as well as expectation. Communication and customer service did not meet changing needs.

3. Change and Transition

We carried out the IT restructuring as planned but had to address transition issues along the way to ensure staff retention. The impact of restructuring on people, both individuals in the IT division and users, was sever. Many IT members went through prolonged anxiety about changing roles, responsibilities, relationship with co-workers and users. Users expressed equal frustration about learning new skills and fear for job shift. It became quite clear that we had to address the transition process for individuals in order to implement the planned change. Transition management differs from change management in many ways (Bridges, 1993). Change is an external process, often driven by events, situations, outcomes, and external environment. It emphasizes a new beginning and intended results. Transition, in contrast, is a process internal to specific individuals. It has three distinct phases--ending, neutral, and beginning--and starts with the ending. We assisted individuals through formal learning forums and informal communication to acknowledge their loss and the pain associated with the restructuring. We also emphasized a project approach to help those individuals to establish early success in moving into a new beginning.

III. Phase Two: Expanded Information Access and Services

The rapid development of infrastructure achieved during the first eighteen months brought the university community to a new environment and heightened user expectation.

1. Rationale

Changing Technology Environment. The 1993 restructuring enabled the IT division to move the university from a lagging position to a competitive environment. Completion of the network infrastructure and new client server applications required the division to reposition itself as a service provider and a change agent, capable of improving work process through technology.

Changing Institutional Needs. The new technology environment afforded the university numerous opportunities to develop innovative strategies. Technology solutions became imbedded in academic and service strategies. The IT organization has to collaborate with user community and adopt a strategic view in selecting and prioritizing its projects in order to harvest the benefit of technology investment

Changing User Expectation. Our client base has tripled since 1993. Six to seven thousand students joined the user community in the 1995-96 academic year. Users of different proficiency level and needs further complicated the design of new service models. Measures of IT success shifted from infrastructure work to customer service, from technology solutions to our ability to vision and facilitate work redesign.

2. Strategies

We continue to follow the five principles, mentioned above, to guide this second round of IT restructuring. A four-prong approach was taken to improve services and information access.

Restructure and Streamline Functional Groups. The seven small, flat functional groups accomplished the advantages of empowerment, cross training, reestablishing working relationship, and consolidation of technology platforms and operation. However, coordination across division was still problematic. To allow better coordination and more effective communication with users, functions for the seven groups were streamlined to form four functional groups while maintaining the same unified vision and culture.

- Information and Application Support (IAS): Focused on client server, work process redesign and migration of legacy systems
- Network and Telecommunications: Full responsibility for voice and network support, including network software support
- Academic Technology Development: All instructional and research computing, instructional technology, and student Internet support
- Management Support: Focused on customer service, management practice, user communication and IT policy research

These changes gave each functional group a complete set of service responsibilities and accountability. Although an additional layer of managers was incorporated into each group, we balanced the organizational design by emphasizing team leadership and new horizontal processes.

Strengthen Team Leadership. This team, composed of the vice president and four directors, developed a heightened sense of shared responsibility through a commitment to priority projects, team problem solving, and management practice. This team was responsible for quality assurance and exercised a discipline in project planning, management, and customer service..

Develop New Cross-Functional IT Processes. Four horizontal processes were established to improve user support. Objectives and expected outcome of each process are clarified for each process group.

- Software Research -- Expertise from ATD, IAS, and N&T was drawn to research, evaluate, and plan software selection, acquisition and installation before implementation. This process helps to achieve knowledge sharing and improved delivery of network software upgrades and support.
- User Computing Training -- Each functional group was responsible for conducting user training workshops on a designated network software package. This approach establishes direct, personal rapport with new users. It also instills a division-wide, shared commitment for user training.
- Help Desk--The process is coordinated by N&T but all groups provide higher level support. New policies and procedures were established to ensure a single point of service to the user community.
- Customer Service--A customer satisfaction action plan was supported by all groups. Measures and benchmarks were established for maintenance functions as well as new initiatives.

Forge Proactive Partnership with Users. A customer satisfaction action plan was developed to articulate products, services and clientele. This plan includes eight components:

- university plan for information technology
- IT policy development process
- voice of the customer
- project management and communication
- customer satisfaction card
- customer communications
- operational performance measures
- rewards and Incentives based on user satisfaction

This approach enabled the division to design appropriate messages, communication strategies, and user support. Staff in the division received training in customer relations and communication. Besides various electronic and print communications, the division holds regular technology and project updates for users. Key user groups receive customized support.

3. Outcomes and Deliverables

- new voice services for 1700 resident students
- DePaul Online: Internet SLIP services for students
- DePaul In-Touch--campus-wide information access
- enhanced student bills
- student and user training and services
- suburban campus support
- faculty microcomputing service
- support for distance learning
- remote Access for faculty and staff
- enrollment management data warehouse
- extend use of legacy systems
- WWW applications
- data policies and procedures
- a new fund-raising and donor tracking system

- redesign of student-centered processes and systems

IV. Two Case Studies

The IT division responded to changing institutional needs in two phases of restructuring. The initial restructuring in 1993 was to create an organizational infrastructure for implementing technology infrastructure. The realignment in 1995 was to reposition the division as a service provider and change agent. How did the IT restructuring affect users? What are the implications of these rapid, massive organizational and technological changes for the IT division? The impacts of these changes are examined in two cases from several perspectives.

Case #1: Network and Telecommunications Support

In the network support arena, the completion of university network infrastructure at all campuses by early 1996 will bring 3000 faculty and staff users into the Novell, Windows-based environment. Completion of networking for student residence halls would bring over 1,700 students in a "port per pillow" environment. The DePaul Online could potentially connect the remaining 15,000 students with the university.

a shift from infrastructure work to provision of quality service--network operation, software support, help desk, and risk management--becomes a top priority. After the aggressive building effort, ways to ensure currency in technology and infrastructure become new challenges.

New Environment. Our client base nearly tripled since 1993 in an integrated network environment. We had to serve different generations of users; some are novice, some demand advanced technologies. Users now depend on the network to perform their tasks. They expect a stable work environment and a full range of free services. They view network standards and policies as signs of centralization in a traditionally entrepreneurial university environment.

IT Internal Conditions. The Network and Telecommunications group embraced the values of innovation and learning organization. They had little old technology to shed and quickly transitioned into the new work environment. They adopted a project management discipline and implemented networks at a fast pace. This in turn breeds staff expectation for new learning opportunities and career growth. Most of network staff valued projects over maintenance of network operations or user services.

Realignment Strategies. We realigned the network staff and service to meet user demand for reliable network performance and responsive services. The group was restructured into three sub groups--network operations, telecommunications service, and help desk. We moved technically oriented individuals into the network operations and staffed the help desk and telecommunications groups with people of strong service orientation and contact management skills. Several new members were recruited from other departments, such as placement service. The position of help desk manager was upgraded to confirm our commitment to service and the importance of a service-oriented career track within the division. We also created two cross-functional teams to support users at the two main campuses. Offices were reconfigured into an open space at the two locations to foster integration of voice and data services and personal contacts with users. Users are consulted to develop service standards and policies. Bonuses and performance appraisals were linked to user feedback.

Results To Date. While many of these strategies are still being implemented, user response has been extremely positive. Ratings for services during October and November 1995 showed more than 95% satisfaction. Timeliness in project completion received an a rating of 86% satisfaction due to poor coordination in October. Improvement was made immediately and raised the November results to 95% satisfaction. Current members appreciate the parallel track of service and technology orientation. The redesign of work space was essential in making the realignment successful.

CASE #2: Client Server versus Legacy Support

In the client server arena, we are implementing an Oracle-Microsoft Access application to support reengineered fund-raising process. Object-oriented rapid prototyping and application development were used. We worked with consultants to rearchitect the enterprise data model for building an integrated student system. This two-year project, when completed, will replace home grown legacy systems. It is critical to develop new skills for application staff. How to target and motivate developers for these new learning opportunities while maintaining support for legacy systems is a delicate balancing act. In designing and deploying new client server solutions, we were also challenged by users' learning curves in using the technology.

New Environment. Our intensive effort in user training increased their knowledge about technology and information. Restructuring and reengineering in other university functions also raised their expectation for rapid technology solutions. Several user groups began to establish their IT support staff to cope with increasing dependency on technology. However, dependency on legacy systems continues as most of data still reside on the mainframe. Users showed mixed reactions to new client server applications; there was anxiety about steep learning curves and job shifts to be introduced in a client server environment.

IT Internal Conditions. Obsolete technology and gaps in skill profiles delayed our timetable to migrate off the legacy systems. Many individuals in this group attached their professional identify with the legacy systems and had trouble in transitioning into a new environment. There was also growing tension in resource allocation between on-going legacy support and new systems development. New systems demand skills and experiences that few possessed.

Realignment Strategies. The Information and Application Support group was realigned into four subgroups -- new systems, legacy support, systems administration, and production -- following the system life cycle. Any systems, regardless of technology or platform, would eventually move from new systems to the production phase. A complex system project would require support from members of several subgroups. We also developed a client server architecture (Unix, Oracle, Windows, Access), partnered with venders and consultants in systems development. To ensure project success, we also redesigned work space, created special project team rooms, emphasized user ownership in major projects.

Results To Date. Both users and IT staff experienced difficulty in transitioning into a client server environment. It would take much longer to achieve the desired change in this case. While these projects received much attention, it is important to maintain ongoing legacy support as the majority of mission-critical applications are still on the mainframe. Tension between the new systems group and legacy support had to be addressed promptly. Because progress in legacy support tends to receive less attention, special effort is required to encourage steady operations and responsiveness in problem solving. We sponsored many individuals for learning new tools. They did not always have opportunities to apply new skills immediately. It would be more effective to synchronize training with project assignment.

V. Implications

Reflecting upon DePaul's experience, it would be appropriate to view IT transformation as a process of managing at least three overlapping phases of change and transition. The first phase focuses on building organizational and technology infrastructure. The second phase emphasizes expanding information access and services for users. The third phase evolves around process innovation and integration, probably the most difficult to achieve. Each phase calls for different organizational design, skill sets, processes, and relationship with user community.

What we have learned is that IT restructuring ignites a process of continuous change, because the institutional context and the IT internal processes and dynamics are changing constantly. The challenge we face is how to expand our capacity to manage change and transition.

1. Successful Strategies

Five strategies have been critical to our ability to implement the transformation:

- A focus on outcomes and deliverables motivated the IT members to transition into a new environment and develop a sense of pride.
- Rigorous project management enhanced the success rate of on-time delivery. This discipline is adopted by all groups. Even routine maintenance tasks are now formulated as special projects to assure rigorous monitoring and timely completion.
- Flexible organization design, coupled with flexible staff and budget management, allowed the division to move nimbly in responding to university needs. A divisional perspective in resource management is necessary to avoid building new turf walls after initial restructuring.
- A discipline in performance management, linking individual's deliverables with divisional goals and project timelines is most critical in ensuring divisional performance. A reward structure that allows market adjustments and incentives for high performance prevented the attrition of some newly trained professionals.
- Adoption of a customer service attitude is a challenge for technical staff but our attempt so far has improved the division's image. Frequent feedback, direct communication, and personal contacts are keys to establishing relationship with customers. User feedback cards gave us quantitative evidence of problems, improvements, and user satisfaction.

2. Challenges

The pressure that higher education institutions are facing in the coming years will require IT organizations to embrace continuous change. An understanding of what this continuous but radical change, or transformation, is critical for IT professionals. These changes have sever impact on people and must be carefully managed.

- Transition management is not well recognized in a change process. Acknowledgment of pains and difficulties associated with change helps individuals to move toward a new beginning. Creating a work environment that ensures small but early success from day one helps build confidence in individuals for sustained change. Those in leadership positions should take a special effort in working with individuals during the change process to build trust.

- Restructuring should be coupled with continuous quality improvement to achieve sustainable results. Radical changes need to be implemented quickly to capture the momentum and energy. It is difficult to anticipate all the consequences of change, even in a carefully constructed plan. Incremental adjustments afterwards are appropriate to ensure services, quality, and impact on users.
- Adopt a transformation process for continuous change will become a key to successful IT operation. Alternating between redesign, restructuring, and slower-paced quality improvement can build long-term results. However, the pressure on high education may soon propel IT organizations to quicken the pace for continuous change. Developing the organization's and its members' capacity for IT transformation will be a challenge few can avoid.

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Transitioning the Organization: A View from the Inside

by

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Several colleges and universities are in the process of integrating their information resource providers by merging computing services and the library. Almost two years ago Gettysburg College announced plans to create a new division of Information Resources (IR) comprised of computing services and the library. To facilitate the merger of the two operations, IR pursued a reengineering strategy. The result of this reengineering effort was an organization composed of six self-directed, process-oriented teams. The transition to the team-based structure began in January 1995.

Transitioning the Organization: A View from the Inside

Several colleges and universities are in the process of integrating their information resource providers by merging computing services and the library. There are a number of reasons why an institution may wish to pursue this strategy. These include the similar nature of the provision of information by each organization and how many futurist predict that more and more of the information that is provided on paper will be provided digitally in the future.

Almost two years ago, Gettysburg College announced plans to create a new division of Information Resources (IR) comprised of computing services and the library. To facilitate the merger, IR pursued a strategy-driven reengineering effort. The result of this seven-month task was a single organization comprised of six self-directed process-oriented teams. The teams represent a melding of the two organizations. Each team is comprised of staff from both organizations. The new IR division is responsible for the delivery of all computing and library services on campus, including telecommunications and media.

The transition process to the new organization has been underway for close to two years and is still very much a work in progress. In this presentation, we will describe the transition process. We will describe some of our successes and some of the pitfalls we have encountered. We also will attempt to forecast some of the upcoming turns in the road.

Where We Came From

To give you a thumbnail of the environment, Gettysburg College is a private, liberal arts college in south central Pennsylvania, approximately 80 miles north of Washington DC and about 60 miles from Baltimore, MD. Our enrollment is approximately 2,200 undergraduates. We are loosely affiliated with the Lutheran church. We will be 165 years old next year.

President Gordon Haaland and Provost Baird Tipson announced the decision to merge the computing and library organizations in December 1993. Provost Tipson described the reasons for the merger as the need for a flexible, streamlined organization to support use of resources in all formats, an organization well positioned to lead the campus community in new and innovative methods of using information technology.

In December of 1993, there were approximately 28 full time library employees supporting access to a collection of 400,000 volumes and 1,400 serials subscriptions.

The organizational structure was a traditional, hierarchical one. In technical services, for example, there were 4 layers of reporting plus a layer of student workers effectively making a fifth layer. Many employees had been in place for a number of years. There was a history of faculty complaints regarding lag time between request for a book to be purchased for the library collection and availability of that book within the collection.

In the computing organization in the fall of 1993, approximately sixteen individuals supported both administrative and academic computing needs on campus. About four years before the merger of computing and the library, the computing organization had been reorganized to merge academic and administrative computing. In addition to faculty and staff, there was a heavy demand for services from students. Every residence hall-room had at least one ethernet connection per bed.

The computing organization was swamped by user requests. This organization had been in flux for some time. There was a tradition of individuals holding loosely defined positions where they were expected to fill several roles. For example, the bookkeeper running the computer store also gave training sessions on basic computer skills for first year students. Prior to the merger, the computing organization had a series of training sessions on TQM methodology and team dynamics. Both served them well as a foundation for this new organization.

The Reengineering Process

The reengineering effort was a top-down, strategy-driven effort. It attempted to simultaneously address people, organization, process, and technology. To facilitate the reengineering effort, Axiom, Inc., an international consulting firm, was hired. The analysis and planning for the new organization was conducted by a core team comprised of three IR staff, an Axiom consultant, and the vice-president of the new division, Dennis Aebersold. The authors of this paper were members of the core team.

To ensure communication and a steady flow of ideas between the central team and the rest of the organization, the core team met with an extended core team comprised of six to eight staff members several times a week. During these meetings, the core team would describe current issues and ask for input. The extended team provided an immediate response. Following the meetings with the core team, members of the extended team would hold meetings with other members of the IR division over lunch to discuss progress and solicit input. This information was provided to the core team for consideration.

One or two times a month, the entire division would meet to discuss the reorganization. The topics of these meeting ranged from the wording of the mission statement to identification of activities performed by the organization.

As part of the analysis and design of the new organization, the core team conducted an environmental analysis of the division and the college to identify constraints and boundaries that could influence decision future decision making.

The core team also developed a mission statement that was agreed to by all members of the new division. The mission statement communicates the purpose and intent of the division to all stakeholders in the college.[1] A value statement was also developed. [2] These two statements provided a context for subsequent decision making by the project team. They were also used to build the new organization by conveying purpose and identity to motivate employees. These two statements were also a key component for developing the six self-directed work teams. In addition they serve as a guide in daily decision making.

With input from the entire division, a set of goals and enduring objectives were developed. These goals were based upon the mission of the new organization. After developing the goals, a set of measures was developed. The measures were to enable the organization to evaluate its performance against targets.

An employee opinion survey and a cultural assessment were undertaken to identify the strengths and weaknesses in the organization. The assessment also identified priorities and preferences for working conditions within the division. The assessment posed questions about the prevailing culture of the library and computing services organizations. The assessment sought information concerning what changes staff would like to see in the future.

The needs and values of the division's stakeholders were evaluated also. Stakeholders are defined as individuals and groups--both internal and external--who have a stake in the success of the division or who are affected by its actions. Stakeholders include faculty, students, staff, alumni, as well as residents of Gettysburg.

One charge to the core team was to innovate operations of the new division. To do this, rough-cut activity models were developed to illustrate how operations were being conducted. Clear and logical models of the major cycles of the organization--such as the beginning of the academic year or how an information resource was obtained--were subsequently developed. These cycle models represent the sequence of activities that need to be performed to achieve strategies. The models map what happens from the trigger that kicks off the cycle through the activities required for successful completion.

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[1] The mission statement is: The Information Resources division develops and provides information services and resources needed for the learning environment at Gettysburg College.

[2] The value statement is: The division fosters an atmosphere of open inquiry and continuous education for all members. This demands highly qualified, flexible and team-oriented members committed to excellence and the value of the educational experience.

Organizational structure models were developed that would best support the activity and cycle models. The results of the cultural assessment were reviewed in light of generally accepted management paradigms to provide ideas for the structure of the new organization. An array of structures, ranging from a hierarchical model to a form of a matrix management to the present team based framework, was considered. The cycle models were reviewed to determine logical units of work. This analysis, along with the organizing criteria, became the starting point for preparing and developing the organizational structure. The core team decided to adopt a team based strategy for the new organization. The teams were to be self-directed and organized around specific processes. The teams reflected the six groupings of activities and cycles: training, selection, delivery, response, planning, and special projects. The organization could also create special projects teams that would exist as virtual teams and would be responsible for specific projects that generally fell outside the scope of the other six teams.

The roles, responsibilities, and skills that are needed to enable the new organizational structure also were considered. The members of teams require specific knowledge, skills, abilities, and personal characteristics (KSAPs). These KSAPs were identified and documented. In constructing the teams, attempts were made to match individual KSAPs with team needs,

The core team also created a measurement system based on the goals and the activity and cycle models. This measurement system was designed to allow self-correcting feedback to the organization so that it could pursue its strategic direction.

The core team developed a change management plan to direct and manage efforts to bring the new division to fruition. The transition was managed by a two-person transition team. The transition team was responsible for establishing the six self-directed work teams and fostering their development. The transition team was also responsible for providing training and obtaining resources that would be needed by the new organization during its early development phase. The transition team was the organization's first special projects team.

Transition Process: A Staged Process

We chose to implement the new organization as a staged process for a number of reasons. A key reason was practicality. We wanted to ensure success. We wanted to make sure we had sufficient resources available to address any unforseen problems. We brought up the initial set of three new teams in January of 1995 and the second set of three teams in June 1995. We also wanted to minimize any disruption of services. As part of the transition, we were operating two separate organizations.

During the initial stages of all the teams' implementation, a great deal of time was spent in meetings. The transition team met with each team twice a week. The teams met among themselves several times a week to sort out which activities were appropriate for the new team. Some individuals needed to shed activities that belonged with a different team. The teams needed to establish new ways of organizing work and new ways of interacting with co-workers. One individual made the statement that it felt as if she was involved in a marriage with eight people in it.

The transition team's role in meetings with the teams was to provide a forum for safe conversations. The meetings began with a state agenda. The transition team frequently adjusted the agenda to address immediate concerns as they emerged. Teams would sometimes suggest agenda items for inclusion.

The design of the meetings included a warm up activity. The topic of these warm up activities were drawn from *The Team Handbook* by Peter R. Scholtes, et. al. (1988). These warm up activities included such things as having each person talk about what they liked to do on weekends or talk about some aspect of their home town. Even though we thought these topics were not threatening , we found over time some individuals objected to them. In one instance, a member of one team became very upset and burst into tears about having to talk about that member's home town. In other instances, team members welcomed the opportunity to share at length moments about their early years.

Occasionally, the warm ups would last for more than half the time allotted for the team meetings. We found these sessions to be extremely useful as members of the team began to recognize their team mates as warm and caring individuals. The warm up activities were very successful especially with the larger teams who had not worked together very much before the merger. After the formal transition period was over, several individuals said that the most beneficial aspects had been the warm ups and the ability to shift focus from a planned agenda to address immediate concerns.

Following the warm up sessions, we discussed much of the aspects of the business process renewal project described above. These included a review of the mission and values statements, the objectives and goals of the organization, and activities related to the particular team. We also talked about team dynamics such as communication, ground rules, decision making, etc.

After these initial topics were covered with the teams, the transition team tried to minimize its involvement with day-to-day activities of the new teams. Meetings with the teams were reduced to once per week. Subsequently the meetings were held every two weeks and the teams took shape. The topics of these later meetings usually focused on clarification of the team's role. In a few instances, these meetings were used to nudge the developing teams back on a course.

Lessons we learned

We learned a large number of things in the course of this transition. We found the experience to be one that resulted in a great deal of personal growth. It was also an invaluable experience in the management of change.

For those of you who may start down this path, we offer the following suggestions:

- *Don't allow individuals to be members of more than one team.* We had included some individuals on a short term basis on the initial teams, thinking we were temporarily over staffing them to help them get through the initial, difficult period. This was a failure--the short timers were not committed to the team, caused friction and interfered with the process.

- *Try to avoid hiring people as temporary members of teams.* We had a hiring freeze during the analysis process until we determined where the positions should go. We hired some people on a temporary basis which created some tensions. We are still filling those permanent positions. It is a pleasure to bring in new, enthusiastic, committed people. If at all possible, accelerating that process of identifying the needed skill sets and recruiting new people in with enthusiasm and without baggage would have been really helpful.

- *Resist the urge to fill every position as soon as it opens.* Wait until the teams are formed, then use the positions to acquire skills or abilities that may be missing from a team.

- *Take your time.* Be patient. There is no rush. It is more important to take the time needed to develop and nurture the teams than it is to declare victory.

- *Use outside consultants.* Do not hesitate to use whatever resources are necessary (and available) to bring in someone from the outside. Not only will the outsider provide a different insight, but they also will not carry baggage.

We also had a number of successes we'd like to offer, too:

- *Warm up activities.* The warm up session probably did the most to ensure the success of each team. As facilitators, you can acquire a wealth of information about individuals about what they are saying; whether it is personal or not and how much they are willing to talk about it.

- *Use free flowing agendas.* Resist the temptation to cut agendas into stone. One technique that some teams use is to allocate a fixed amount of time to an agenda topic. As a result, the focus becomes completing the discussion within the amount of time devoted to it and not on resolving the issue.

- *Use meetings as sounding boards.* Allow the teams to experiment and challenge each other in the meetings. Encourage them to reflect on what they are doing at that moment, how they feel, and why. Gently encourage them to challenge their assumptions.

SOMETHING NEW!

A Bachelor's Degree in Information Studies

**by
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Computer Science. Management Information Systems. These have been the underlying academic programs supporting the use of Information Technology on our campuses for over 50 years. Today, there is a new kid on the block. Information Studies!

This paper examines the past and looks to the future in dynamics in curriculum reform that is taking place across America as we prepare for the 21st Century and educate the USERS of information. We give credit to the pioneers of this curricular reform--Pittsburgh, Drexel, and Syracuse. MIS, Computer Science, and Information Studies are contrasted as academic disciplines. Highlighting the program will be a review of the core courses and electives that make up this exciting degree program. The audience will be given an opportunity to vote, in real time, for the critical courses from their perspective.

The closing will include a summary of costs for implementing such a program and the political and administrative hurdles facing "change agents" who dare to initiate a new program in a state-funded, research university in the face of declining budgets.

SOMETHING NEW!

A Bachelor's Degree in Information Studies

The ***information society*** had it beginnings in 1956 and 1957. In 1956, for the first time in American history, white-collar workers in technical, managerial, and clerical positions outnumbered blue-collar workers. Industrial America was giving way to a new society, where, for the first time in history, most of us worked with ***information*** rather than producing goods. The following year, 1957, marked the beginning of the ***globalization of the information revolution*** when the Russians launched Sputnik, a precursor of satellites which provide the missing technological catalyst in a growing information society, introducing the era of global satellite communications.[1] In the information society, we have systematized the production of knówledge and amplified our brainpower. To use an industrial metaphor, we now mass-produce information the way we used to mass-produce cars. The new source of power is not money in the hands of a few but information in the hands of many.[2]

The ***restructuring of America*** from an industrial to an information society will be profound. In the information society, change is occurring so rapidly that there is not time to react, instead we must anticipate the future. With this new society, there is a change in time orientation. That time orientation is to the future.[3]

In an information society, for the first time in civilization, the game is ***people*** interacting with other ***people***. This increases personal transactions geometrically, that is, all forms of interactive communications--telephone calls, checks written, memos, messages, letters and more.[4]

Ten years into the "information age," the U.S. Department of Commerce produced the first documentation of the ***information economy***. Through a painstaking dissection of the nation's economy and the establishment of criteria for categorizing jobs as part of the "information sector," some 440 occupations in 201 industries were identified as information jobs. This incredibly detailed study identified Primary Information Sector jobs such as clerks, librarians, systems analysts, and the like. In 1967, they represented 25 percent of the U.S. Gross National Product (GNP). A new information grouping called the ***Secondary Information Sector*** were the workers who produce information goods and services for internal consumption within goods-producing and other companies. This sector produced an additional 21 percent of GNP. The study concludes that the information economy accounted for some 46 percent of GNP and more than 53 percent of income earned. This was in ***1967!***[5]

We have for the first time an economy based on a key resource that is not only renewable, but self-generating. Running out of information is not a problem--we live in a ***sea of information***. For example: Over 7,000 scientific articles are written each day. And, scientific and technical information now increases 13 percent per year, doubling every 5.5 years.[6]

The Changing Workplace

Half-way through this century, work was comprised of tasks that were outer-directed, mechanical, and easy to supervise. Today, with the service-oriented, information economy dominating the developed world, it is an entirely different workplace. It is almost impossible to "supervise" information work. Mental tasks have replaced mechanical ones. "Work" is what goes on inside people's heads at desks, on airplanes, in meetings, at lunch. It is how they communicate with clients, what they write in memos, what they say at meetings. Peter Drucker points out that we are managing people paid for their knowledge. We have never done that, and we don't know how to do it.[7] The current Administration's emphasis on the "Information Superhighway" and building the National Information Infrastructure is very quickly increasing the speed at which America is changing.

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[1] John Naisbitt, Megatrends, New York: Warner Books, Inc., 1982, pp. 11-12.

[2] Ibid., p. 16.

[3] Ibid., p. 18.

[4] Ibid., p. 19.

[5] Marc Porat, Information Economy: Definition and Measurement, Washington, DC: U.S. Department of Commerce, May 1977, p. 12.

[6] Ibid., p. 34.

Jobs in the Information Economy

The information economy is producing an extraordinary number of well-paying, challenging jobs. However, one must possess the required skills to do those jobs. The information economy jobs require a high degree of competence on the part of the individual worker. The U.S. does not presently have the trained human resources to fill those positions; nor will it for the rest of the 1990s.[8]

What is Information Studies?

The primary focus of Information Studies is the ***information user***. Questions of the field emanate from the behavior of the user and from the interaction of the user and information products, services, and organizations. The field's megaquestion is "how to most effectively link the best available information with the users who need it." Additional questions relate to the creation of information products, ***the satisfaction of user's information needs***, and the analysis of information content.

Since the 1970s, the field of ***information studies*** has been increasingly recognized as a discrete academic field of study, which is interdisciplinary in nature. It is becoming increasingly clear, as our society moves more firmly into the "information age," that there is a need for people with an understanding of the many facets of the information process--***from collection and storage to dissemination and use***. And, they need to have the technical skills to support that understanding. The professional and popular literature have begun to focus on the increased demand for individuals with skills in the information field, and several of the leading schools in the country have instituted undergraduate programs in response to this need.

An Historical Perspective

The FSU School of Library Science (SLIS) was established in 1947, as an outgrowth of the Department of Library Science, organized in 1926. At that time both undergraduate and graduate programs were offered. Bachelor's degree in library science were popular in the 1920s and '30s; for example, the Peabody Institute of Johns Hopkins University offered a Bachelor's of Library Science as a five-year program in the '30s.

An Overseas View

Most of the major universities in the United Kingdom with "schools of information and library studies" offer undergraduate degrees. In fact, the College of St. Catherine has been involved in undergraduate library science and information management curriculums since 1929.[9]

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[7] John Naisbitt and Patricia Aburdene, Megatrends 2000, New York: William Morrow and Company, Inc., 1990, pp. 219-220.

[8] Ibid., p. 42.

[9] Internet message from Mary Wagner, College of St. Catherine, March 5, 1993.

The University of Wales has three undergraduate programs--Information & Library Studies; Information Science; and Information Management.[10]

Shifting to Information Studies

Since 1972, the ALA has interpreted "***librarianship***" and "***library science***" in their broadest sense as encompassing the relevant concepts of information science and documentation. Whenever the term "libraries" is used, the current models of media centers, information centers and brokerages, information, documentation and referral centers are also assumed.[11] Called "***library schools***" since 1887, by 1972, when the current Standards for Accreditation were adopted by the ALA, the new term, "***information science***," had been added to the names of seven schools to create the combination "library and information science." One school preferred "library and ***information services***." These changes in terminology were intended to reflect the growing importance in library operations of what was frequently called the "new technology," or more specifically, information technology. This approach is also regarded as the "librarians" traditional role of viewing information from the users' perspective and assisting patrons to resolve their information needs. There was also the growing recognition that the training being offered in many library education programs would equip students to be "***information specialists***" who could serve effectively in settings quite apart from the traditional library.

No fewer than ***54 of the 59*** library education programs accredited by the ALA now combine "information science" or some other form of the term "***information***" with the word "library" in their name. And, at Florida State, the change was made to "***library and information studies***" in 1981.

Three programs have abandoned the very word "library." At SUNY-Albany, it is called simply, "information science," and at Drexel and Syracuse, the programs carry the name "information studies."[12]

ALA Standards for Library & Information Studies

The American Library Association, in its role to develop standards for the accreditation of library science programs, published its latest standards in 1992. In these standards, the most authoritative definition of the field is found.

> *The essential character of the field of library and information studies is concerned with recordable* ***information*** *and knowledge, and the services and technologies to facilitate their management and use. It encompasses* ***information*** *and knowledge creation, communication, identification, selection, acquisition organization and description, storage and retrieval, preservation, analysis, interpretation, evaluation, synthesis, dissemination, and management.*[13]

What Information Studies is Not

It is inevitable, when one discusses the need for an ***Information Studies*** program, that a comparison is made with ***Computer Science*** and ***Management Information Systems***. Certainly, these three programs need to work together to avoid duplication and overlap. Yet, the presence of these three programs at one university offers synergistic opportunities for the faculty and students to work across programs for the benefit of all.

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[10] Internet message from David Stoker, University of Wales at Aberystwyth, March 5, 1993.

[11] State University System of Florida, Program Review of Library and Archival Studies, Tallahassee, FL: State University System of Florida, October 1989, app A, p. 4.

[12] Ibid.

[13] American Library Association, Standards for Accreditation of Master's Programs in Library & Information Studies, 1992, Chicago, IL, January 1, 1993, p. 9.

Information Studies is probably least like ***Computer Science***. As a reference point, consider the definition of that field of study from the *Classifications of Instructional Programs:*

> ***Computer Science***. *An instructional program that describes the scientific and mathematical study of algorithms used in designing and building computers, and their application to the development and design of actual computing systems. Includes instruction in computer architecture, assembly and programming languages, numerical and computational analysis, computer systems theory, artificial intelligence and cybernetics, and simulation and modeling.*[14]

Note that ***Computer Science*** places considerable emphasis on communicating with computers through programming languages. Thus, it is a look inward. ***Information Studies*** takes an opposite position of looking at the information that comes from computers. And, its consumers want not to communicate with the machines but rather understanding the information generated by the computer systems.

A program in ***Information Studies*** may appear closely related to a program offered by the College of Business, ***Management Information Systems or MIS***. However, the "closeness" is evident in only a few words and phrases. Again, this is best illustrated by its definition as found in the *Classifications of Instructional Programs:*

> ***Management Information Systems and Business Data Processing, General.*** *An instructional program that generally prepares individuals to provide and manage data systems and related facilities for processing and retrieving internal* ***business information****; select systems and train personnel; and respond to external data requests. Includes instruction in cost and accounting information systems, management control systems, personnel information systems, data storage and security, business systems networking, report preparation, computer facilities and equipment operation and maintenance, operator supervision and training, and management information systems policy and planning.*[15]

The emphasis of an MIS program is on the use of information in a business or formal decision-making setting. The emphasis in Information Studies is broad, looking at the use of information across all sectors--public, private, and personal. Information Studies also is distinctive in regards to other disciplines in that its focus is on ***resolving user's information needs.*** It accounts for the hardware, software, and financial concerns but views the ***user*** as the ultimate evaluator of an information system's performance.

The Pioneers of Information Programs at the Bachelor's Level

In the past 15 years, only a few universities have taken the initiative to begin bachelor's programs in information "something." These institutional programs are described below.

1. The ***University of Pittsburgh*** established the first such program in September 1979. It offers a "***Bachelor of Science in Information Science***" which integrates knowledge from fields such as communications, computer science, cognitive science, math, philosophy, engineering,

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[14] U.S. Department of Education, loc. cit., p. 71.

[15] U.S. Department of Education, loc. cit., p. 196.

business and others. Its goal is to prepare students for careers in diverse and exciting information professions.[16]

2. ***Drexel University*** instituted its program in September 1984. A ***Bachelor of Science in Information Systems*** was developed "to meet the demand for individuals skilled in the development of information systems and in the management of information." This forward-looking program for undergraduates offers a solid background in liberal arts and sciences as well as skills and knowledge needed to design, create, manage, and effectively use modern information systems."[17]

3. ***Syracuse University*** began offering an undergraduate major in information studies in 1987 with its first ***Bachelor of Science in Information Studies*** being awarded in 1991. Students can follow one of four concentrations--Information Resources Management and Consulting; Information Research and Services; Information Systems and Telecommunications; or Paraprofessional.[18]

4. ***SUNY-Albany & North Texas State University*** have both developed heavily interdisciplinary bachelor's programs that use the "I" word. However, these programs appear not to be a high-priority for the schools. Yet, they are available if particular students wish to pursue them. At SUNY, the program grew out of an BS/MLS combination degree program and is now basically a bachelor's degree in Information Science, as of the Fall of 1989.[19]

Information Studies Curriculum Goals and Objectives

The goals and objectives for this new degree program were developed by the faculty of the School and approved in October 1995 by the University Curriculum Committee.

a. Information Studies Program Goal

To prepare graduates, within the context of a liberal arts education, with knowledge, skills, and values required to develop, organize, store, retrieve, administer, and facilitate the use of ***recordable information*** and ***knowledge*** and their management and use to prepare individuals for service within an information-dependent, global society.

b. Information Studies Program Objectives

- Develop an appreciation for the history, philosophical basis, concepts, theories and methodologies of information and collections of information.
- Understand principal types, functions, and organizational patterns of information service organizations.
- Appreciate the user's perspective, needs, requirements, and tasks in various information use environments.
- Provide the communication skills to effectively serve as information brokers and information intermediaries.
- Understand and utilize techniques of selecting, evaluating, and providing access to a full range of information resources.

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[16] University of Pittsburgh, Bulletin, Pittsburgh, PA, June 1991, pp. 31-43.

[17] Drexel University Undergraduate Curricula, Philadelphia, PA, August 1993, pp. 152-154.

[18] U.S., Congress, House, Committee on Science, Space and Technology, Hearings on Federal scientific and Technical Information Policy, "Testimony of Charles R. McClure, Professor, School of Information Studies, Syracuse University, October 12, 1989, p. 1.

[19] The Rockerfeller College School of Information Science & Policy Bulletin, State University of New York-Albany, Albany, NY, 1991-93, p. 5.

- ➪ Provide an introduction to the systems approach to problem-solving and the theories of information delivery systems.
- ➪ Provide an introduction to the development and uses of information resources, their general concepts, definitions and literature.
- ➪ Provide an introduction to the methods of information analysis and presentation.
- ➪ Understand the roles of systems designers, intermediaries, and information users in developing efficient and effective information services.
- ➪ Understand the cultural, linguistic, social, political, and economic implications of the information age.

The Information Studies Curriculum

The curriculum for the Information Studies program was developed over the period of two years. It draws on the curricula used at Syracuse, Drexel, and Pittsburgh. Copies of the course syllabus for all of their course were examined and related to the unique goal and objectives of this program. Additionally, the School's faculty played a significant role in developing the course list and syllabi for this program.

Students enter this bachelor's program after completing the state's Liberal Studies program and 60 semester credit hours of course work or transfer with a comparable amount of academic work. Thus, the students entering this program will be taking the last half of their 120 semester hours of course work.

Ideally, students entering this program will take the following ***core courses*** in their first year in the program.

FIVE New Undergraduate Core Courses:
- Information Science
- Information Sources & Services
- Information Needs & Preferences
- Technologies for Information Services
- "C" Programming Language for Non-Specialists

EIGHT New Undergraduate Elective Courses:
- Managing Multimedia Information
- Societal Implications of the Information Age
- Quantitative Methods in Information Studies
- Managing Information Resources and Services
- Usability & Usefulness of Information Systems
- System Approach in the Information Environment
- Network Administration for the Information Professional
- Natural Language Processing for the Information Professional

SEVEN Dual-listed Electives from the Master's Program in Information Studies:
- Information Services
- Seminar in Information Policy
- Theory of Information Retrieval
- Information and Image Management
- Managing Networks & Telecommunications
- Organization of Non-Bibliographic Information

New Program; New Students?

In developing new programs, there is always a concern by other academic units that their resources and even their students will be "sucked" into the new one. And, this could happen. First of all, the student growth at Florida colleges and universities is on the rise. So, adding programs is looked upon favorably by the State University System (SUS) of Florida and like governing bodies for the private sector. As more students come into the system, enrollment dollars follow. Thus, there are some assumptions made in developing a model of costs for such a new program.

First, there is the assumption that FSU will start out like the other universities that started these degree programs. So, data from Syracuse, Drexel, and Pitt suggest the program will start with about 30 students and double for the early years. Thus, by the end of the third year of the program, some 100 students would be in the system. These numbers are then entered into a formula on funding and tell the budget staff that the will be costing about $400,000 annually and generate over $500,000 in new monies for the university.

Secondly, it will take faculty and staff to put this program into operation. Again, following the normal build-up experienced by other universities, the program would generate 4.5 FTE faculty and 1.5 support staff. This will allow about 22 courses to be taught each year and adequately meet the demand of about 100 students. One of the new staff resources will be used to manage the new computer technology and the half position will be used to help with the administration of the new program.

Resources Essential to a New Program

As part of the development process, all of the resources essential to the implementation of a new degree program are evaluated. For example, a new program and 100 more undergraduate students will require additional library resources. The State funding formula provides the dollars for additional library materials and even human resources. Existing classrooms were judged to be adequate to handle the new group of students but additional laboratories would be needed. Additions to existing labs would include:

A doubling of the ***Computer Laboratory*** to 40 PCs. The addition of a ***New Technology Instructional Laboratory*** which will have one-of-a-kind new microcomputers and workstations, loaded with new or beta version software. A new ***Usability Research Laboratory*** is planned to develop and teach various aspects of usability and usefulness of approaches to ergonomics. It will also contain an electronic whiteboard and a video camera system to record testing sessions.

In addition to these facilities, the students will be able to use the existing labs and teaching facilities, which include: the ***On-line Laboratory*** contains the file server for the local area network, the network printers, and the documentation to support the on-line courses; the ***Cataloging Laboratory*** contains three OCLC terminals that are connected via SOLINET to the OCLC bibliographic utility; the ***Conservation Laboratory*** which is used to teach the practical aspects of conservation and preservation of books; a ***Graphics Laboratory*** that is used to teach practical methods of creating graphical items, such as passe-partout, drymounts, overhead transparencies, computer generated posters and signs, bulletin boards, etc.; and the ***Audio-Visual Laboratory*** which features audio visual (AV) equipment used in school media programs.

What do graduates of Information Studies programs do?

Now that the program is ready for implementation, a good question is, "What do graduates of Information Studies programs do?" Graduates of programs in information studies are employed in a variety of public and private sector positions that serve to ***link information***

users and information products and services. Current graduates work as information product and service designers and manufacturers and as independent information service providers.

Graduates are found in such areas as: information services & support; information specialist; network administrator/coordinator; planning services; technology licensure & testing; information systems services; educational information services; information support & analysis; reports & forms management; information program support; telecommunications specialists; network services; office automation specialist, end-user trainer, information product evaluator, information designer, information analyst, information technology planner, information researcher, data security specialist, usability analyst, on-line searcher, information broker, and Internet site architect.

Where do Information Studies graduates work?

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Taking Time to Train Students

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ABSTRACT

It is very easy to overlook the training needs of our student support staff. Many of us depend more and more on students to provide consultation support to end users. It is more difficult to train students because of varying schedules, turnover, and time constraints. Yet, in many cases they are our first line consultants.

This paper will present some useful techniques that University Technology Services at The Ohio State University has utilized when training students. Below is a brief outline of the major topics to be presented.

I Determining training needs

A. Customer Service
B. Evaluation of technical skills
C. Scheduling training

II. Training options

A. Typical Classroom
B. Independent Training
C. Self-directed Training
D. Apprenticeship
E. Role Playing
F. No Training

III. Costs & Support

A. Direct & indirect
B. Cost of not training
C. Management support

INTRODUCTION

As we become more dependent on the help of students, we also become more vulnerable to errors that can occur if they do not have adequate training to perform their jobs. Because of limited time and resources, we often hire students and provide only the most basic instruction. Using this technique, there are bound to be errors made when situations arise that they have not been trained to handle. Even if they do try to find the answer, their supervisor is all too often not present.

Consider the following case studies, they are real situations with names removed. I'm sure you have had similar experiences. The key is learning from these experiences to reduce the possibility of them occurring at your facility.

Case Study 1 - A customer calls the help line for assistance on a problem with his e-mail. Because the consultant was unfamiliar with the type of computer, the entire mailbox was deleted, instead of just one message. When the angry customer called back, he was told the supervisor would be in touch. The supervisor was on vacation for two weeks. You can imagine the result.

Case Study 2 - The computer center was shutting down a computer system because it's maintenance contract was very expensive. This decision was not too popular with many users who had become familiar with the system. One user posted a note to a newsgroup expressing his displeasure. An employee of the computer facility posted a message that agreed with the user and added some comments on an uncaring management system.

Case Study 3 - A customer had to go to a campus office to replace a lost access card. He arrived at the office at the beginning of the working day to find all of the employees grouped in the back of the office drinking coffee. He waited at the desk for several minutes before they finally broke up and retreated further back into the recesses of the office complex. Another 10 minutes passed before one student came out to one of the computer terminals and acknowledged his presence. He was unable to find the customer's record due to a "new computer system" and had to return to the recesses to find someone to help. The customer then had to provide his ID and had to fill out three forms with name, address, city, state, the make, year, model and license plate of his car, etc. The customer was given the incorrect change in the transaction and his ID was not returned until he asked for it. It is not difficult to understand why the office has such a poor reputation on campus.

I suspect all of you have had similar experiences. The damage to the image of the department is difficult to measure, but the outcome is not desirable. We know the need for training, but where do you find the time, resources, and money to conduct the necessary training? Inadequate or no training can be very costly as well. In this age of change, downsizing, resizing and decentralization we need to concentrate on providing the best service possible. Our very survival may depend on how well we perform. Contrast this with businesses who are competing for your customers. Your local pizza shop knows your name and your usual order. Bank clerks have been trained to use customer's names and ask if there is anything else they can do for you.

Training students in good customer service techniques will pay dividends in multiple ways. The cost of training in the basics can be kept within reasonable limits. The following are some things you can do to keep the cost of training as low as possible.

Distribute the training responsibility across the department. This reduces the time required by any one person or group within the department. This can be made easier by conducting some train the trainer courses. This allows you to use some of your more advanced students to do the more routine training tasks.

Utilize existing courses. For standard courses there are a number of books, video, and computer based training courses available. You can also look at other colleges and university courses and see if they offer similar training. If so, ask to borrow materials and modify them to your particular needs. Browse the Web and Gopher systems of those institutions and see what is available on-line. OSU, for example, has all of our documentation on our gopher system. All of Ohio State University's publications are available at the following URL:

gopher://gopherjr.acs.ohio-state.edu:6051/11/DOCSGopher

Another example of using others work on Internet training is

this URL:

http://www.yahoo.com/Computers_and_Internet/

Internet/Guides_and_Publications/

In short, spend a little time to find what others have done and use whatever material possible. Of course ask permission and give credit to your sources.

Develop training in short modules and reuse the modules in multiple training courses. Use standard software for training presentations. This allows multiple instructors to utilize each others work. I will be "recycling" some of our train the trainer materials in this presentation. I also utilized material contained in "How to be a Better Trainer", a video course available from CareerTrack Publications[1]

DETERMINING TRAINING NEEDS

The most important need is to determine your specific training requirements. As the above examples illustrate, you may have both technical and customer service needs. We often concentrate on the technical side of training, forgetting that the customer service component may be the most critical.

Before you start you need to write down the objective for your training, answering the questions below.[2]

- Why are you conducting this training?
- What specific skill or knowledge do you want your students to have when your training is completed? Be sure to target gaps in knowledge or skills, not attitudes or morale.
- Who will be attending this training? How can you tailor the training to fit the schedules of the students?
- Logistics - How long will it last (number of hours) and where can are you going to conduct the training?
- How do the individuals feel about attending the training?
  Survey the needs of the group
  Give a pretraining questionnaire
  Speak with a few of the participants
  Provide outline of training prior to workshop
- Is the training going to be formal or informal?
- Do you have specific tasks or behavior you wish the participants to perform after the training?

Writing a lesson plan for training:[3]

- What is the content of the training in outline form?
- What materials do you need to present?
- How will you evaluate the competence of trainees?
- How will the training enhance their job performance?
- How will you evaluate the trainers performance?
- How will the students evaluate the trainers performance?

As I have mentioned before, one area of training that is easily overlooked is that of Customer Service. This is one area in which most students will not have had any formal experience. This is a critical issue since many times the students are the first contact callers may have with your department. Sandy Li, who spent many years in our Customer Service, area presented a paper on this subject several years ago.[4] In that paper she quotes the seven sins of customer service.[5]

Apathy
Brush-Off
Coldness
Condescension
Robotism

Rule Book
Run-around

While these may seem obvious, they are sometimes difficult to prevent, especially if your students are not aware of how to avoid them.

Technical skills are something that you must always be working on in the training area. In the computer world, it seems like major changes occur every day. At The Ohio State University we hold small "mini" training sessions of 1 hour duration on a regular basis to keep our consultants updated. Recently we held several on Windows 95, and how to modify our client server software. We also make the documentation on-line so that anyone can access up to date information.

TRAINING OPTIONS

Once you have answered the basic questions determining training needs, you must decide on the best delivery techniques. Some of this will be determined by your logistics, and whether the training is to be formal or informal.

When doing the design of the course, start with the key points and objectives you want to communicate to your audience and focus the training on those points. This is one of the main points made on certification courses designed for computer support professionals at the University of Indiana.[6]

Next you need to select the appropriate training methods, the most common is the old tried and true Classroom/Lecture. It is well suited for large groups, when you have factual material, and you want focus on the trainer. It is very economical in time and resources, which is why it is used so often. The disadvantage is it is not interactive. There are several ways to improve the standard lecture format. One technique is to call on volunteers to come up and do the computer demonstrations, or perform a similar task just demonstrated. This tends to prolong the demonstration, since the volunteer will make mistakes, but showing how to correct the errors is important as well. I also try to tell stories that relate to the specific area I am trying to teach, to bridge between the theory and the performance of a task.

Some individuals like the independent training method. Given a problem, they will go off and find the resources needed, and solve the problem. This type of training is very attractive to management, but it may not be the most efficient. Some individuals may not seek "experts" when they are stuck on a point and waste time trying to find answers.

Self-directed training is similar to independent, the individual is directed to books, video courses, self-paced computer based training. The Ohio State University has pulled together several of these types of materials and make them available through "learning centers", where individuals can make an appointment or check out materials. These include topics such as WordPerfect, DOS, Windows, Lotus 1-2-3, Excel and other popular topics.

Another technique, is the apprenticeship. This is normally used when you hire a new person and assign them a mentor who is located in the same office or very near. In this age of electronic communication you can do similar things by having an individual follow anothers posting to newsgroups or mailing lists.

A technique which I have found to be useful when training consultants is through the use of role-playing. I will break a machine in some way and have one person act as the person calling in with the problem. The other trainees will place chairs facing away from the person sitting at the computer and try to resolve the problem. We do a round robin with each trainee spending five to ten minutes trying to discover the problem. Since everyone can hear what questions are being asked they can build on previous questions. The consultants have found this very valuable, since they see how other consultants diagnose problems.

Of course you have the option of not providing training, but this will cause frustration and dissatisfaction among employees. In the long run it will be more costly for your department. If you see the need I feel it is worth it to do all in your power to see the training is provided.

COSTS AND SUPPORT

The cost for training is sometimes difficult to quantify. Employee satisfaction, lower turnover rate, better customer relations, and other benefits are a direct result of good training. There are many other direct and indirect benefits of well trained student staff members. In many customer service and consultation areas, it is possible to appoint an experienced staff member as a mentor to the students. Students can then observe the staff member, who can make them aware of the reason they deal with customers in a certain way. They can emulate the techniques of the mentor and provide good customer service.

It is helpful to have management support for training but there are many ways you can build training into your everyday working life. If nothing else, provide materials of various types and suggest projects that would involve the use of the materials. Encourage the active participation in conferences as presenters or session chairs. When returning from conferences, share with others in your facility the things you learned.

Implement at least one idea that you found helpful in a conference section. I recently returned from a training session on improving presentations. I took the highlights of those items I learned and worked with Gail Peters, the person in charge of Education and training at UTS, and turned it into a short one hour train the trainer session for our department. In this session I have included a mini-session on how to use Netscape for searching. I intend to use this same mini-session on Netscape, in some form, in several presentations throughout this year. The more you can reuse these small modules of training, the less "cost" you incur for the training.

SUMMARY

In this paper I have provided some general guidelines to determine your training needs. Once you have determined the needs, you can design the course based on the results you wish to obtain. Finally, decide on the best delivery system, keeping in mind that you can design the training to be most useful for a number of different training needs.

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[1] Helen Sutton, How To Be a Better Trainer, (Boulder: Career Track Publications, 1993) p1.

[2] Gerry Mitchell, The Trainers Handbook, (New York: amacom, 1993) pp. 186-187

[3] Thomal Leech, How to Prepare, Stage, & Deliver Winning Presentations, (New York: amacom, 1993) p. 85

[4] Sandy Lee, "Training Students on Customer Service Excellence," ACM SIGUCCS, Oct. 1991, pp. 191- 193

[5] Karl Albrecht, At America's Service, (New York: Warner Books, 1992) pp. 14-16

[6] Diane Jung-Gribble, "EDCERT: Education Certification for Computing Support Professionals", ACM SIGUCCS, Oct. 1995 pp. 169-173

TEAM TEACHING THE INTERNET: THE UNIVERSITY OF ARIZONA EXPERIENCE

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ABSTRACT

The University of Arizona Library has forged partnerships with the Center for Computing and Information Technology and the University Teaching Center to develop Internet training sessions for our own staff, and for University faculty, students and staff. Utilizing both the staff expertise and the resources of each unit, we have developed a dynamic and effective program which assists members of our campus community in understanding how to access Internet tools and integrate Internet resources into their research, curriculum and classrooms. Teaching and learning models have been developed, first for our own staff and then for our users, which are continually modified based on our growing experience. Models are based on a conceptual framework which includes principles of adult learning in a constantly changing electronic environment. All of this has taken place amidst a background of organizational change which has provided a team-based library organization strategically positioned to respond to our academic communities' changing needs and directions.

Why are campus partnerships unique? Shouldn't collaboration among different academic units and departments occur naturally? Shouldn't we mix like peanut butter and jelly, fed by shrinking resources, common goals, shared interests and complimentary expertise?

What we have found at the University of Arizona Library is that the actual partnerships, once thought about and formed, are hugely successful. We simply do not think of each other often enough when assessing, planning and implementing programs. Creating partnerships requires a new way of looking at our campus resources, our staffing , our constituencies and our desired outcomes.

We abandoned the more familiar, but competitive model. We wanted and needed to share dollars rather than compete for them, to identify common purposes rather than differences, such as preparing our students for an increasingly information-based society. We looked not only within, but beyond our own units and departments for expertise, knowledge and training.

We are going to give you a specific outline of how our partnerships evolved. But because context is everything, we are first going to say a little about the University of Arizona Library and how we positioned ourselves for collaborative activities.

BACKGROUND AND REORGANIZATION

The University of Arizona Library is a large Association of Research Libraries(ARL) Library with a collection of almost 8 million items and a staff of 213 full time employees. We serve a campus community of 34,000 students, 26,000 of whom are undergraduates. Three years ago, we underwent a major reorganization. Existing departments were dissolved, reporting structures were collapsed, our physical layout was reconfigured. Nothing looked the same as it had before. It was an enormous and dramatic change. It was participatory, with most staff actively involved in the planning and implementation process. We are not suggesting that organizational change is a requirement for seeing and doing things differently. There are, however, several assumptions which shaped our

reorganization. We think many of these were designed to allow us to be strategically situated to meet changing campus needs.
The following are our assumptions:

* Continuous Learning is one of the hallmarks of our new organization. It is assumed that being prepared today does not mean being prepared tomorrow. Functions, responsibilities and organizational priorities will change. We value and support a dynamic learning environment.

* The organization itself is dynamic and will grow and change.

* User self-sufficiency is a goal. It is important to develop helpful interfaces and self-mediated learning opportunities, as well as training and instruction that encourages user independence or helps users develop the skills that will lead to more independent use of our resources.

* We are a user-centered organization where needs assessment, evaluation and planning are key.

* We are a team-based organization.

The organization moved from a hierarchical model to a flatter model with fewer administrators, departments and reporting lines. Within this new structure we created a team-based environment which stresses cooperation, consensus building and team responsibility for decision making and problem solving.

Every employee is technically "loaned" to their current team. Ann, for example, is loaned to the Undergraduate Services Team and the Science-Engineering Team, while Louise is loaned to the Fine Arts/Humanities Team. Team leaders are assured their positions for only three years, at which time the positions are open to rotation of staff. Special interlibrary teams, such as mission teams, process improvement teams and strategic tactic teams are ad hoc formations, designed to solve a particular problem, implement a particular plan, or move the library toward one of its stated goals. This structure was designed to increase our ability to bring together the talents, skills and experience needed to get a particular job done, to respond to timely issues, and to give people the tools they need to thrive in a cooperative working environment.

It is in this team-based, user-centered, continuous learning, and constantly changing environment that we created our Internet teaching project It is in this environment our partnerships have developed and flourished..

Our Internet Training Program began with two librarians recognizing a window of opportunity and wanting very much to stick our heads through it. We knew that there was a strong need on campus to introduce both students and faculty to new technology and electronic search strategies. We knew the importance of integrating information and computer literacy into the classroom and curriculum. And we knew that our moment had arrived.

We formed--what else?-- a team of four librarians and set out to develop instructional materials and sessions which would effectively help train our own staff, capture the interest of faculty members, and be effective learning and teaching sessions for our students. We developed sessions which could be given by trained librarians. Because we developed models for each session, we were able to use them to train our own staff and also adapt them to our different campus audiences. We will describe the development and design of these sessions in more detail later. At about the same time the University's Center for Computing and Information Technology (CCIT) weathered a sizeable staff cut. Because both the library and CCIT were developing Internet training sessions, we decided it was time to join forces. What could we offer each other? The Library had two Electronic Learning Education Classrooms equipped with 12 workstations and a demonstration station. The design of these classrooms made them more effective teaching facilities than the classrooms at CCIT.

We had complimentary expertise and teaching experience. As librarians, we could draw on our past experience in developing and teaching the online catalog, database searching, and CD-ROM technology. We saw ourselves as the experts in understanding how information is organized, how to help users identify and locate appropriate resources, and how to help them think critically about the information they found. CCIT personnel had the technical experience and expertise our users were demanding. They answer questions such as, "How do I set up an E-mail account or a Listserv for my class?" and "What kind of equipment do I need for remote access?"

Interestingly enough, we discovered we all were moving more toward understanding adult learning theory and instructional design. Working together to create the instructional models, develop the supporting materials and team teaching the sessions was an ideal collaboration. CCIT had also perfected month-by-month online calendars of training opportunities and we had a mailing list of all the departments, both of which enhanced our public relations efforts.

During this same time the University had embarked on a mission to "transform" Undergraduate Education. Faculty were being given both opportunities and resources to enhance their teaching skills. While teaching students was our ultimate goal, we knew that partnering with faculty members was also critical. If we taught them, they could then encourage students to make use of these resources and bring them into the library for instructional sessions.

In support of the University Mission, the University Teaching Center developed a series of five-week courses for faculty to help them improve teaching and introduce new technology into the classroom. They taught classes on issues such as learning theory, cognitive development and presentation software. They asked the Library and CCIT to team teach sessions on the Internet. This was an opportunity for us not only to teach Internet skills, but introduce examples and ideas for integrating electronic access and critical thinking skills into the classroom. We also asked that the Teaching Center critique our work. This request led to some significant changes in our instructional format. We invited the University Teaching Center staff to develop a series of sessions for librarians and CCIT personnel on such topics as adult learning and instructional design.

Based on our work with the Teaching Center and CCIT, we were asked to participate in a two day retreat on Teaching and Technology for University faculty. Here a blending of faculty from many academic disciplines, the

University Library, CCIT and the University Teaching Center came together, and through workshops, demonstrations, brainstorming sessions and discussions, explored methods of teaching. This was a very key development for the library, because here were the people in the University interested in, invested in and motivated around using technology to enhance teaching.

PROGRAM DESIGN

In the fall of 1994, the Center for Computing and Information Technology (CCIT) and the University Library teamed to design and create a series of Internet workshops. By combining the strengths of the members of each unit, both CCIT and the Library hoped to reach more students in a more effective manner and have a larger pool of instructors to draw upon. This workshop would be offered in the library's electronic classrooms and be taught by two people working together, one from CCIT and the other from the Library.

The collaboration began when a group of four librarians and three of the staff from CCIT met to compare current class designs, methods and handouts. The librarians also brought examples of handouts from other libraries. From this material, the group chose the most relevant, adding local information, discarding duplicate materials and combining the rest into a coherent whole. One of the CCIT people created a slide show using Powerpoint; the librarians created handouts detailing features of Gopher, Veronica, the World Wide Web, File Transfer Protocol(FTP), Listservs and Accessing Online Catalogs. These handouts were designed not only for participants to take for use after the workshops but also for instructors to use as outlines for their presentations.

The first session designed was an overview of the Internet, an introductory workshop where participants would get a taste of what could be found "out there". It began with an introduction to the Internet, including a brief history, the concept of the Internet as a virtual community and a realistic picture of what is available. The ideas that we are all learners and teachers who should be approaching the Internet with the spirit of discovery were emphasized. This portion was designed to be about 15 minutes long.

Short demonstrations with brief descriptions of each program or concept took up another 30 minutes. These demonstrations at first consisted of why and how to subscribe to Listservs, connecting to online catalogs and using Gopher and Veronica. The World Wide Web, FTP and WAIS were mentioned if there was time. Once participants had been introduced to various aspects of the Internet by listening to the introduction and watching the demonstrations, the tactile learners were addressed by allowing about 30 minutes for practice. To guide participants, they were given the option of trying some practice exercises or exploring on their own. Presenters changed roles, becoming monitors, to assist hands-on learners.

Also in the initial design, 10 minutes were reserved for discussion on how the faculty in particular might use these resources in their research, curriculum development and/or teaching. Issues such as gender bias on the Internet and ideas like building your own Web site were to be explored. Five minutes were reserved for a summary of what was learned, mention of current trends and issues and announcements of future sessions. An evaluation survey which asked for feedback on the amount and type of material covered as well as suggestions for future sessions was also included. This is not how it usually worked out in reality.

IMPLEMENTATION

Staff training is the most important element in implementing any new service. Veteran instructors from both CCIT and the Library teamed to teach the initial sessions. Other CCIT staff and librarians attended sessions to familiarize themselves with the flow of the session and to gain confidence in their own teaching abilities. The first workshop was actually piloted by presenting it to library teams and asking for feedback. To foster the sense of discovery and the realization that we are all learners, librarians were encouraged to assist by keyboarding and being available during the practice sessions. It was hoped that many more librarians would gain the confidence to join the ranks of the instructors. This has yet to be realized in full measure, though the number of instructors from both CCIT and the Library has grown.

With the speed of change on the Internet, the original concept for the Internet Overview changed as well. By the spring of 1995, based on returned evaluations, the Listserv and accessing online catalog demonstrations had been relegated to the introduction. The new standard Introduction to the Internet session now consisted of the introduction and alternating brief demonstrations with hands-on practice sessions. The demonstrations included Gopher, Veronica and connecting to the World Wide Web using Lynx and Mosaic. A separate session on Listservs also debuted that semester.

The Teaching Center critique of an Internet session for faculty also brought dramatic changes to the way we taught the workshops. A better understanding of learning theory and learning styles drove these changes. The introduction, which had turned out to be closer to 20 minutes than 15, was slashed to less than 10 minutes. The demonstration/hands-on practice sometimes became guided exercise with explanation after the exercise and much more time was reserved for hands-on practice. The Internet sessions for faculty alone are now geared toward how the faculty can use the technology in their classes and research. The open Internet sessions, which have a more varied clientele, concentrate on accommodating different learning styles, fostering a spirit of discovery and instilling the concept of critical evaluation of resources. All variations of the Internet sessions are designed to build on the existing skills of the participants and to guarantee each participant will leave having had at least one successful experience during the workshop.

CONTINUOUS LEARNING AND TRAINING

Other changes have also occurred. Gopher and Veronica are no longer emphasized; Netscape has replaced Mosaic; concepts are taught using Netscape rather than Lynx. Sessions on creating your own homepage and an advanced Internet workshop debuted this fall to overflow crowds. For each change, the combined CCIT-Library team gathered together to design and create the new workshops. Team teaching is an expected and welcome aspect of this collaboration.

Our partnerships and programs continue, and continue to grow. This past summer, a librarian requested that librarians be appointed to the CORE Curriculum Planning Committees which were being formed to help revise curriculum in the University's foundation courses. A common core curriculum will replace several general education programs. These courses will be formed around the themes of Traditions and Culture, Natural Sciences and Individuals in Society. The charge to the individuals developing the courses includes designing a significant writing component for each course. Teaching critical thinking skills in each course was also an element in the initial charge. Librarians, CCIT and Writing Center staff sat on these committees to provide resource assistance in the development of the core courses. The librarians also presented four Internet workshops for these faculty. As a direct result of librarians' involvement, one committee changed its charge to include introduction of new technology into the curriculum.

FUTURE PLANS

Two new developments take us into the present and the future. One very exciting collaboration is the Faculty Partnership Fund. This is a $940,000 grant award which is being shared by the Library, CCIT, the Teaching Center and the Triestman Center for New Technologies. This partnership "functions under the umbrella concept of Faculty Development, an initiative that aims to provide a structure for assisting faculty who wish to adopt innovative interactive teaching techniques and procedures." [1] It emphasizes the use of multimedia, networking, simulation and exploration in the development of learning-centered education. Money is going to personnel, equipment, software and operations. The Library has received money to create a prototype information commons in our Main Library reference area. It will invite students to explore graphic, text, and multimedia software programs to support their own interests. Ethernet connections will be provided and the furniture will foster collaboration. We will also be able to upgrade one of our electronic classrooms with multimedia-capable workstations, color scanners and a variety of software programs . The classroom will be open in the evenings to faculty who are working on innovative teaching projects. This brings us closer to our goal of being a truly learning library.

Finally, the library has mounted a strong program to enhance librarian and faculty partnerships. These partnerships will create research programs and assignments which integrate information literacy, with an emphasis on new technologies, into the classroom and the curriculum. Each Integrative Services Team, which contains the bulk of our public service librarians, is expected to develop at least seven new partnerships this year. A team of librarians and career staff are working to ensure the success of this project by creating a foundation of support services. Individualized assistance to improve skills in use of technology is available to our staff. Workshops on learning theory and instructional design are being planned. Resources both on campus and beyond are being offered. A variety of opportunities are being planned from shadowing effective teachers, to videotaping instructional sessions, to sharing effective models.

We feel that with this last initiative we have made a complete circle. We have identified our own needs and interests, found colleagues who share these goals, combined expertise, resources and creative efforts to develop programs to meet present needs and future goals.

1 New Learning Technology Spending Plan (Tucson: University of Arizona, 1995)

Supporting Information Technology - The Evolution of a Model

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Abstract:

Victoria University of Technology was formed in 1992 as a result of the merger of two Institutes of Technology. This merger brought together a diverse set of technologies, services and support practices.

The authors discuss their attempts to set up a centralised Help Desk to cover the geographically dispersed institution and the introduction of Help Desk technologies in an attempt to balance the demands of the customer with the available skills of the staff. Some approaches to raise the skills of information technology support staff to provide quality service in a distributed environment covering six campuses spread over a 50 mile radius are also presented.

1. Preamble - A Historical perspective of Information Technology Support

In trying to develop the appropriate model for the support of Information Technology, especially in a University environment, it is interesting to briefly examine the organisational development of computing and its support models.

Management of computing resources and their support needs have to a large extent been influenced by developments in technology. In the early days of computing, support was at a local level by the people actually using these highly specialised machines.
As they became larger and more applicable to commercial and general applications, computer centres were set up to concentrate the large investments and the expertise needed to manage and support it. With the development of the personal computer, the "end-user" became more responsible for provising support. Then, as networks , developed, support again became more centralised. Now, the technology is such that there is a need for support at the user or "client" level for the many minor problems that can occur due to hardware, software or local networking issues in the work place, as well as support from the centre by specialists. This support generally relates to the corporate or strategic systems and the corporate network. The central support services can also provide a valuable service in coordinating bulk or site software licenses, equipment purchases and setting procedures and standards to assist in standardisation of data models and software interoperability.

This paper is an abridged account of one new University's experience in introducing a Help Desk and grappling with improving support services during a time of uncertainty and rapid changes. It is not a unique tale. It may sound very familiar to staff from many Universities, especially new ones or ones where there has been a major restructure or a radical change in culture.

It is however our story.

2. The formation of a new University

Let us first set the scene by spending a brief moment introducing you to our infrastructure and organisational framework, which, by the way, is still in the process of developing its own identity and work culture.

The Victoria University of Technology (VUT) was established on the 1st Jan 1992 as a result of the amalgamation of the Footscray Institute of Technology (FIT) and the Western Institute (WI) - both located in the western metropolitan region of Melbourne.

FIT was a single campus institution founded over fifty years ago with a focus on Engineering, Business, Applied Science and Arts and at the time of the merger had about 7000 students (5500 efts).

Computing was provided through a central Computer Services Department (CSD), managed by the CSD manager who had an academically linked position. The CSD managed several computing platforms, supported the student administration system, the main campus network and four central computer student laboratories. They ran a small computer shop, some training courses and provided limited technical support to Schools and departments. There was no Help Desk or any central booking or work scheduling system. Calls for support were rung through to operations, the central office or the workshop or to any individual the user could contact the Schools such as Engineering and Business ran their own computer laboratories and had their own support staff. Others, such as Applied Science and Arts also had their own computer laboratories and provided their own desk top computing support. Schools provided hardware repair services and assistance with networking, especially cabling. The administration, apart from student administration, used a mix of packaged support and external bureau services for computing support.

The Western Institute of Technology (WI) was 5 years young and had been set up as a new initiative in Education. It was established to provide a continuum of education from TAFE (community colleges) through to higher degrees. At the time of the merger, the Institute had three campuses, each about 15 - 20 miles apart, about 3000 students and was growing rapidly with many buildings (especially on the main campus at St Albans) in different stages of construction.

Information Technology support was provided through the Information Systems Unit (ISU) to support the administration and the Educational Computing Unit (ECU) to provide academic computing and networking support. Two physically different networks had been set up; one for administrative access and one for academic access. The ISU developed application software using Informix and supported various commercial packages. The ECU was part of the Faculty of Business. It had developed the academic computing network throughout the Institute and installed and supported about 15 computer laboratories (each with 20 personal computer). These were used by all Schools and departments.

The merger brought together a wide range of computer hardware including CDC, IBM, SUN, MIPS, Sequent, and Encore. Three networking systems were used: Banyan, 3COM and LAN manager. Personal computing at the Footscray campus was entirely DOS/Windows (and some OS/2) whilst at the other campuses it was a mix of DOS/Windows and Apple.

Following the merger the three different groups were merged into one department called Information Technology and Services and a new Director was appointed (from outside the University). Within this merged department three branches were established.

The CSD manager from the Footscray campus became the Manager, Computing and Networking Services (CNS) Branch, the former head of Educational Computing Unit from the St. Albans campus became Manager, Client Services and the former head of the Information Systems Unit from the former Western Institute became Manager, Administrative Computing Services. Each of these managers have University wide responsibilities for six campuses. The merging of the different cultures and the changes in the roles for the senior staff was achieved with considerable pain.

3. Establishing an infrastructure

During the amalgamation negotiations, it was recognized that the soon-to-be-established University required a number of fundamental services including:

1. a uniform and easy to use telephone system
2. a communications network that ensured the teaching and administrative processes functioned in an uninterrupted manner, and
3. standards.

Prior to the amalgamation, a Communications Steering Committee was established and was made up of the senior IT management, specialist subordinate staff, and knowledgeable academics as well as an external consultant (who was subsequently appointed as the new Director IT&S). This committee reviewed and implemented the necessary communications strategies to ensure that :

1. all campuses would have access to a common PABX service and
2. all campuses had communications links capable of accessing the central
3. administrative and academic systems.

Apart from the inevitable amalgamation politics, work practices continued at the campus level as they did before the amalgamation

Following the merger, it was recognised that information technology in the University will be best served by identifying the principal functions.
These were identified to be :

1. developing and implementing administrative systems
2. providing a communications and network infrastructure
3. providing support to the University community for technology services;
4. developing and implementing information technology standards;
5. assisting in the enhancement of academic pursuit.

The current structure is based upon the acknowledgment of these functional requirements.

4. Culture Shock ? Consequential Work Practices....

With the changing structure, there developed in our IT Department a consequential change in work practices. Some of this was intentional owing to politics and personalities that needed time to assimilate to the new way, and some by necessity as a result of the impact many work activities had on the new and wider community. **However, the main focus was to provide the best possible service to our new University community.** What came before us were four key issues :

1. The necessity of getting to know the "new" opportunities that we all had inherited.
2. Learning to let go of prior ways of doing things and thinking about things.
3. Coping with radical change and ensuring people in our Department and outside it **knew** what was going on.
4. Perhaps most importantly, each of the managers in the IT Department had to appreciate their changing roles and scope.

These four issues still face us today - but fortunately, in considerably lesser degrees.

Change can be implemented softly and compassionately but with every intention that the change will go ahead, or, alternatively, change can be implemented in a very short space of time with far more adverse and expensive results. Fortunately, the former has occurred.

To paint the picture a little more, since early 1992, the need to extend information technology services has escalated to an extremely high level. The network at our western campuses had to go through substantial change in order to cope with the new buildings and campuses being erected as well as coping with the increased network traffic between campuses. Although it is acknowledged that we may not be unique in this growth-intensive activity, it should be made quite clear that this is not an exaggerated portrait of growth we have been, and are, experiencing. Indeed, this growth has not slowed down and we believe will continue for some years. For example the last campus was opened at the start of this year (1995) and will be expanded next year. Additional buildings are being constructed or planned for at least three of the campuses. All of these require substantial additional network infrastructure and IT support.

5. The Evolution of a Model

The following are some of the practices adopted earlier to monitor change activities. Prior to the amalgamation the Western campuses had in place a pseudo help desk system using the PC-based Paradox® database software. All reported problems, requests for changes or requests for new services were documented, serially numbered, logged on a database, and assigned to a specific individual for problem resolution. A work authority or Job Request Form was developed. The system was primarily used to:

1. condition our clients to record their requests for changes and to have those requests approved by their supervisor
2. make the solution provider accountable for specific tasks assigned to them - a piece of paper with a person's name means a lot more than a verbal instruction requesting them to carry out a task.

The methodology was merely a call logging and assignment facility. Nothing more. The Footscray campus did not use any formal call logging or problem reporting facility prior to the amalgamation. All calls for assistance were taken on an "as received basis" and mostly by those who the clients chose to deal with.

After the formation of the University, and the establishment of the Department structure, as it is today, the Client Services Branch purchased a commercial Unix-based Help Desk package and put in place a project team, from its ranks, to implement a University-wide Help Desk system. It was decided that *Operation Help Desk* should first happen at the Footscray campus as there was no reporting or call logging system in place at that time, or prior to the amalgamation and the need to formalise support services was greatest on this campus.

Until the Help Desk was fully operational at Footscray, the manual form-based call logging system at St Albans continued to be used. The New Help Desk system was utilised to log calls and to generate reporting for tracking and resolution purposes as the staffing mix on this campus was not skilled at a suitable level to provide a more responsive service to the community. Computer Operations staff (who had previously also provided counter enquires) were partly retrained and became the Help Desk Operators. There was no other choice of staffing in the Branch.

6. Key Issues

The following are some of the key issues which emerged in setting up the new services:

The scenario at this point was that the Client Services Branch was introducing a formal call logging system on behalf of the Department. Staff belonging to this Branch are spread across the five campuses and the Branch has functional responsibility for:

1. Support at the desk-top level
2. Staff training
3. Documentation services
4. End-user computing support
5. Standards and Procedures

It took quite a while for IT staff to recognise the need to formalise the way in which they worked and how they should offer support to the client community. Specialist staff continued to implement change without due regard for documenting their change activities with the justification that they were "too busy to do paperwork". Nor did they communicate any proposed or planned change with their peers in the same department.

The order of the day was to get the job done - it was URGENT. There was an air of need and urgency. The University had to become operational within a very short time frame. New campuses were being commissioned, new buildings going live, students being enrolled. All required the involvement of our Department. At the same time, the Department was providing support to everyday problems and requests for service modifications and installation of new technology.

The Help Desk, in the meantime, became known as ***The Disaster Desk***.

Help Desk staff had absolutely no idea what was going on. All they could do was log each call and forward the problem report to the relevant section leader. There was lot of activity happening around them, but nobody was keeping them informed of what was going on! Growth and change was occurring in too many areas. Criticism was being received from many sides of the organisation - from all campuses. On the one hand clients wanted a solution to their problems within the shortest possible time to meet deadlines they were expected to adhere to; and on the other side, limited funding and limited staffing in the IT area necessitated quick fixes, identifying and implementing solutions that caused the fewest problems, and so on.....

7. Reviewing the Work Model

Although initially there was no formal problem resolution or change management, a number of structural and resourcing changes have been implemented since early 1993. As part of our growth and establishment cycle, we had identified the key actions which would need to be taken to assist our situation.

What became apparent, was the need for prompt notification of problems and the need for prompt resolution to those problems. There was so much change happening on all campuses, a lot initiated by the central IT department itself. **Prompt attention to fire-fighting** was the order of the day.

The Help Desk was not fully utilised as a central reporting mechanism. Problem logging was still happening at the campus level with no consolidated reporting. Specialist IT staff still preferred to receive resolution requests from their clients as well as manage their own problem resolutions according the priorities they each set for their work load. The Help Desk was used only to assign problem calls if the clients chose to report their problems to the respective campus-based Help Desk.

We found that while each section in IT agreed that a central call logging facility was necessary, those same sections did not recognise the need to effectively communicate activities they each were involved in. For example, changes were being made to the network infrastructure and field support staff were not being kept informed of those changes. The work culture in the Department needed to change, and change very quickly.

It became apparent that it was not possible to approach problem resolution or new activity or change activity without effective communication between and within the Branches. We can say quite candidly, that an organization can buy the best technology, spend many thousands of dollars to implement it, but that organization will not survive unless the surrounding infrastructure and attitude is in place and its staff members are attuned to the needs of the client community.

Many of the staff in the IT department were anticipatory of the Help Desk solving all of the Department's communication and priority setting problems. Typically, they expected (and a some still do) the new software to overcome all of their procedural and communications problems as well as their problem and change priority and resolution needs.

In the course of this new growth period, a number of approaches and actions were attempted as measures to overcome apparent communication and resourcing problems. Most of these are now in place or in the process of being implemented.

ACTION # 1 - New Account Manager Positions

At the St.Albans campus, some changes were made to the department's staffing profile. Some of the part.time staff salaries budget was translated to provide a limited number of established positions. The key responsibility of these "new" positions was to "account manage" or represent specific client groups.

1. Day-to-day requests for general assistance and reporting of problems, however, are still placed through and processed by the Help Desk.
2. The representative is required to follow through on any outstanding issues or planned activity that has an impact on IT services or where IT services needed to be changed or implemented that could impact the representative client group.

This model has been very well received and was eventually also adopted at the Footscray campus once the various other actions referred to below were implemented.

ACTION #2 - Establish a Works Review Group

Whilst it was fine to log all calls for assistance on the Help Desk system, there was no built-in mechanism within the Help Desk package that could be used to actually manage changes. A separate procedure was deemed necessary.

A **Works Review Group** was set up and met on a weekly basis bringing information, from each Branch, of planned changes or new activities for review, discussion and feedback. The objective was for relevant feedback to be taken back to the Branches for consideration in their respective project planning activities. **This initiative failed.** Managers did not want the group to determine priorities for projects proposed by or belonging to them. Review group members did not have the background skills to appreciate the impact of proposals brought before the Group; and those that should have attended were needed to work on projects on other campuses, and so forth, and, others just simply forgot to attend!

ACTION #3 - Facilitate Communications

As an interim measure, each Branch set up a generic e-mail box to post instructions and activities such as project timelines, warning message about changes or hot spots, for their staff (who were spread across different campuses). This had an auto CC facility so that other branches were automatically informed as to what was occurring. Since then a more formalised Bulletin Service has been set up.

ACTION #4 - Establish Training and Development Facilitators

We have now established staff training and development **facilitators.** These individuals have become the Branch consultants for each particular software package such as Word Processing, Electronic Mail, Unix, and so on. Their role is to identify the skill levels of Branch staff as well as build up their own levels of expertise in a selected platform to enable them to provide advanced or consultancy-level support.

In addition, a process has begun where every staff member in the Services Branch must go through an intensive training program to provide them with the necessary skills, up to an intermediate level, on every software application package the IT Department supports for Desk Top computing - including a small range of utility software that will assist them to effectively troubleshoot general media, hardware and software problems occurring on the client's desktop. This training covers both the DOS (Windows), UNIX and MAC platforms. There are some exceptions such as SPSS and ORACLE for which specialists are available.

Essentially what has been set up is a grid type skills set. Each support consultant has been allocated one of the most commonly used desk top application packages in which they must become proficient to "expert" level. In addition they must all know the basics of most of the commonly used application packages.

The introduction of this was different from the previous approach to support and is still being refined.

ACTION #5 - Expand the Client Training Program

An intensive client training program was initiated to build up the basic IT proficiency of our clients to a level that we hope will decrease the number of support requests logged by the Help Desk and thereby progressively reduce the Help Desk resourcing issue.

As an information technology provider, whether we like to admit it or not, we impose certain technologies upon our clients. We therefore have a responsibility to build our clients' skills up to at least basic proficiency that will permit them to carry out their normal duties and not feel threatened by the new technology they are increasingly being introduced or exposed to.

Although the number of calls to the Help Desk has still not dramatically reduced, the complexity of calls being logged for prompt resolution has increased placing even more load on the Help Desk, especially on the skills base required. Hence the need to develop expert skills for the Help Desk staff.

ACTION #6 - Establish the Central Help Desk

The University, like most other organizations, has suffered financial restraint.
In turn, the bigger money spenders in the organisation have suffered. Our department falls into this category. With the accelerated growth and extent of change our IT department has been involved in, the allocation of funds toward infrastructure support and growth was, and still is, substantial. We are, nevertheless, seen as one of the bigger money-spenders. As with all IT departments we have not always been successful in obtaining funds for all of the necessary infrastructure-related projects which we (and often the users) believed were "necessary".

The increasing client base, the spread of the client community, the increasing complexity of problems, and the increasing need to introduce new technologies to the desktop were not matched with the number of people in the IT department who had to provide or support the services. As a support department we have a responsibility to accommodate the client's expectations and needs without compromising the quality of support. Field support services on each campus are, however, stretched to the maximum. Establishing a central Help Desk then became essential.

Setting up a campus-based Help Desk was, we believed, an expense which could not be justified, even though it was often requested by the clients at those campuses. By centralising this service, it was possible to place more staff out in the field and get them sufficiently exposed to their community as well as rostering them on the Help Desk - in this way, we believed that the Help Desk has become more empathetic to the needs of the client and has enhanced the support skills needed to resolve a greater percentage of the problems being reported to the Help Desk without referral to a field consultant.

It has also been possible to roster support staff to perform duties on several different campuses. In this way they are exposed to the nuances and perhaps the culture of each campus, thereby enhancing their technical skills, their people skills and therefore the overall service quality, taking their blinkers off and exposing them to a wider and more interesting sphere of learning, tasks and people. Not setting up the campus based Help Desks has also provided financial savings.

8. The Help Desk - Why So Much Attention?

Earlier we put forward the premise that the focus of the Help Desk is in the process of changing and, as an industry, our reasons for establishing Help Desks are also changing. Let us now attempt to explain this.

Whereas in the past we have been concentrating on implementing technology to improve the performance of other technologies, it is proposed that the business focus itself is now being changed, and that revised focus is to improve the technology so that the level of customer service is improved. Perhaps this is a result of the international focus on quality and continuous improvement.

As IT professionals who have been in this industry for a long time, we should remember that he people who took advantage of our skills or services, or works of art ie systems we developed, were called or referred to as USERS. Some of the common phrases included:

"...get the User involved..."
"...have you spoken to the users ?...."
"...user involvement, ..." , etc

The more common reference to those same *users* is now Customers or Clients.

Our focus as IT professionals must change because our customer-base has changed and perhaps for the following reasons:

1. Technology improvements,
2. World trends to improve quality and service levels,
3. Economies in Recession., and
4. Technologically better educated customer base.

We must never lose sight of our customer. Our Help Desk exists solely to serve the customer, not the Help Desk staff.

The Help Desk must no longer be viewed as a poor relation in the Information Technology support area. It plays a key role in the provision of support and can be viewed as the representative of the IT Department as it regularly deals with issues where the work gets done. Information collated by the Help Desk can assist trainers and documenters to identify pockets of staff who require training or additional support documentation. Indeed, your Help Desk facilitates a pro-active service approach.

9. Tools of Trade

The Help Desk is only as good as the people who staff it and the tools they have to work with. There should be no compromise or shortcut to this premise.

Without a doubt, your Help Desk must be attended by skilled and field-exposed staff who can relate to the customer's problems or concerns and can offer solutions to those needs or problems for the majority of calls received. The Help Desk can not be expected to solve every incoming call for assistance so it is essential that Help Desk staff possess a high level of inter-personal skills to handle difficult callers and sustain a high level of customer satisfaction. As it is important to have skilled Help Desk operators, it is equally important to have effective backup support who will be called upon to provide second level support in the field.

Some of the technology that can assist the Help Desk to cover peak call-in loads or to be used as resource-assisting backup equipment include:

1. fax-back information - customer service
2. Interactive Voice Response technology - cover peak loads or after hours access,
3. pager messaging - prompt field support,
4. On-line services - WWW and gopher services and
5. Automatic Call Distribution - better a human voice than an answering service.

10. Marketing Your Help Desk

Promote your service to your customers and do it effectively. Make certain your support service facility or your Help Desk is recognised and has full support of your management and your management's management.

Once you are comfortable with the physical Help Desk setup and resourcing, implement a marketing strategy that will promote your services. Make certain that you have the correct infrastructure in place to sustain any increase in support requests. You only get one shot at your customer and if your marketing, plan fails because your Help Desk could not meet the increased demands resulting from your promotion, it will take a very long time to regain your customer's confidence, let alone support for future ventures or collaborative activities.

Some techniques you can use to promote your Help Desk include:

1. short seminars,
2. publication service,
3. "How to .." tips for services in your publications,
4. Providing summary statistics,
5. Making your clients aware of operating procedures,
6. Conducting customer surveys and
7. Talking to your customers

If the quality of your support is acceptable to your customer, we suggest they would not object to paying for any extras. The Help Desk will continually be expected to maintain the same level of service to the ever-increasing customer base and at the same time not receive any additional resourcing.

Some of the tools and techniques mentioned above will help you to develop a better or more thorough understanding of your customer's needs.

11. Service Level Agreements (SLA)

As more services are expected by the client, funding for those services need to be met by somebody, either you or the client. Service Level Agreements can formalise the support levels as well as ensuring the availability of resourcing necessary to meet those levels.

SLAs are also very effective mechanisms for quality reviews, either by your customer or by the service provider. Ideally this would be done by both parties meeting regularly to conduct progress reviews of service received and provided. SLAs are one very effective step in ensuring your Customer's expectations match the quality of the delivery of services you have agreed to provide.

12. "Customer-Care" Program

A "Customer Care Program" is a valuable approach to formally letting your customer know that you are there primarily to help them resolve problems arising from the technology they need to carry out their business. If new staff to the organisation are made to feel that they can get assistance and are welcome by the technology staff, they will be much more understanding when problems arise. One approach to get them on-side is for the IT staff to:

1. Adopt a Customer Care philosophy and promote it as one.
2. Do a deal with your Human Resources people and have them notify your Help Desk when a new person starts employment.
3. Have the Help Desk introduce itself and the services it provides to those new incumbents.
4. Send out an information kit with useful names and contact telephone numbers.
5. ......make new starters feel welcome.

13. "Frequent-Caller" Program

Study the reports generated out of the Help Desk system and identify customers who are frequent callers. Find out why they are frequent callers and carry out a telephone survey or personal visits to get to know your customers. The aim is to place a face to every name.

14. TQM & Continuous Improvement

The quality of the overall service your Help Desk provides to its customers is only as good as the understanding the Help Desk has of its customers. Some techniques that could be adopted to ensure that quality and continuous improvement remain at the forefront of your Help Desk are:

1. Regular meetings with Help Desk Staff
2. Posters in the Help Desk Room
3. Help Desk staff to meet their Customers

The Help Desk can facilitate Continuous Improvement by providing reports with vital statistics highlighting inefficiencies.

15. In Conclusion

Our story is not finished. The University is maturing. Partly as a result of the training put into place and the increasing sophistication of customers, calls to the Help Desk have started to reduce, but, as predicted, many of the calls are now more complex and take a higher degree of skill to resolve. The Help Desk staff have risen to the challenge and have participated in most of the training, including training in answering telephones and other inter-personal skills. The Help Desk has lost its name as the "Disaster Desk" and is now considered an essential part in providing support services to the client.

The University is starting to establish a good reputation for innovative courses and a good Information Technology infrastructure for its students, who are after all the real customers.

Postscript
Norbert Riedl has since left the Victoria University of Technology to become Director of Information Technology Services at the University of Melbourne which is Australia's leading research university, has about 30,000 students and over 5000 staff.

The IT support model used at The University of Melbourne is a two tiered one. Schools and departments are encouraged to become as independent as possible in the provision of direct desktop IT support to students and staff. The ITS department, has responsibility for the core infrastructure such as telephones, the campus network, administrative systems, large timeshare computers (including several High Performance Computers) and runs an extensive IT training centre providing training to staff and graduate students. **ITS also runs a central Help Desk**. All departments are encouraged to employ (or train existing staff) to be Local IT Experts (LITES) and Local Area Network Administrators (LANADS). Sometimes they are the same person.

The Help Desk primarily supports the LITES and LANADS. Although other staff and graduate students may call the Help Desk they are general referred back to their local LITE unless it is an emergency or the departmental LITE is not available, or is unable to resolve the problems. Over 85% of all problems can be generally be resolved on the direct call to the Help Desk without further assistance. Where it can not be resolved it may require a return call or be passed on to an expert in ITS who then becomes the consultant to the problem.

ITS also runs forums and provides specific training and information to LITES and LANADS improve their expertise. Extensive use is made of an extensive CWIS (using Netscape) to disseminate the information. ITS via the University IT Policy Committee develops the standards and policies on support and annually requires all LANADS to certify that they are administering servers in their areas according to the standards. This certification process is audited by the University internal auditor.

The model is a little different from that at the VUT, but works well for a large institution. It has its shortcomings but is constantly being improved.

It is our aim that the IT support at the University of Melbourne is adaptable and allows the clients to maximise the use of the very extensive IT facilities in the pursuit of academic excellence, for which the University is renown. We wish to retain our place as a leading research University and are using IT as a strategic tool in the process. This requires support services of the highest standard and continuous improvement.

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TRACK 8

ACADEMIC COMPUTING AND LIBRARIES

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Where's the Beef?: Implementation of Discipline-Specific Training on Internet Resources

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With the recent explosion of Internet information resources, Academic Computing and Library organizations face the dilemmas of who is responsible for Internet services and how to best provide these services. This paper describes how two very different universities solved these problems by having Academic Computing and University Libraries jointly develop a series of discipline-specific seminars on Internet resources.

This paper will cover how the seminar series idea developed; seminar logistics, content and organization; how these seminars differed from previous Internet workshops; the strengths both organizations brought to the efforts; measures of the program success; and differences in the implementations.

With the recent explosion of Internet information resources, Academic Computing and Library organizations face the dilemmas of who is responsible for Internet services and how to best provide these services. This paper describes how two very different universities, Vanderbilt University and Western Michigan University, solved these problems.

At Vanderbilt University, the situation was made even more problematic by the recent split between Academic Computing and the Central Library. While the two units once reported to the same Associate Provost of Information Technologies, they now reported directly to the Provost and each was headed by newly appointed Acting Directors.

The past also had its share of turf issues over who would be responsible for Internet resources and support. There had even been an attempt to teach jointly a few Internet workshops. While these workshops were successful if judged by attendance, they were a failure in that the instructors stopped working together. Instead the instructors divided up the courses and went back to offer them in their respective units. The other problem with these workshops was that faculty did not attend in any significant numbers.

So, Academic Computing and Central Library were faced with the challenge of an ever increasing demand for Internet services, a confusion over whose responsibility it was to provide these services, and a partial solution in place. The Acting Director of Academic Computing approached the Acting Director of the Central Library with the idea of focusing on service rather than turf. Instead of dividing up the Internet responsibilities by organization, it was decided to merge the strengths of the two organizations to provide seamless support.

The Acting Director of Academic Computing offered the Central Library more than just rhetoric. She offered a plan for supporting faculty exploration and development of Internet resources. The plan was to have Academic Computing and Central Library jointly develop a series of discipline-specific seminars on Internet resources. The two organizations would offer faculty seminars demonstrating discipline-specific resources available via the World Wide Web (WWW). The seminars would take advantage of the Central Library's departmental liaison program and Academic Computing's expertise in overcoming technical difficulties.

The Central Library's departmental liaison program provided the fundamental infrastructure for building the seminar series. At Vanderbilt, each Arts and Science department has one faculty member who is designated as the library representative. This person works directly with one librarian who is designated as that department's bibliographer. The departmental bibliographer makes most of the purchasing decisions regarding the departmental material funds. In order for the bibliographer to make good choices, the bibliographer has to know the department well. The bibliographer has a variety of ways to stay abreast of the departmental needs: course schedules, faculty information sheets, individual meetings, guest presentations, and library in-services. For some faculty members, the bibliographer is their "personal" librarian. The end result is that the bibliographer is extremely knowledgeable about the department's interest.

The library representative also plays a key role in the departmental liaison program. The library representative usually does the announcements and public relations for the library in-services. Having a faculty member recommending a seminar series helps boost faculty attendance.

In spite of building upon an existing infrastructure, several factors had to put into place before the seminar series could be offered. Support for the program had to be built across the campus. As the Acting Director of Academic Computing met with the deans of the various schools, the idea of the seminar series was discussed and support for the program was acquired. Deans had to be reassured that the seminar series would not be used to increase the demand for more computing resources from them.

Support for the seminar series had to be developed not only across campus but within Academic Computing and Central Library as well. Careful consideration was given as to whom would be chosen to lead the seminar series within each organization and to coordinate across organizations. The library consultant was chosen based on her expertise in coordinating with the library's departmental liaisons to deliver successful faculty seminars. The computer center consultant was chosen based on his communication and technical skills.

While support for the program was developing, the details of seminar series were being worked out. It was decided that the department's library liaison would work with the department on scheduling a convenient time for the seminar. Then the library liaison and computer center consultant would work together on the seminar content. The computer center consultant developed a World Wide Web page of key resources for the discipline which would be distributed at seminar. Upon request, computer center personnel were available to help faculty set up their office equipment to access the Internet resources. In order to assess the quality of the seminars, an evaluation form was sent as a three week follow-up.

The program at Vanderbilt has been judged successful as measured by high faculty attendance and favorable evaluations; academic deans praising the program; professional growth of librarians and computer professionals; increased requests for network connections; increased requests for instructional computing support; and renewed respect and cooperation between the organizations.

Faculty attendance at these seminars was unusually high. All but three departments in the College of Arts and Science have participated in the program. Faculty attendance has ranged from 26% to 100% of the department attending the session. Even in the case of the lowest percentage attending (26%), a total of 27 faculty members attended from that department. Seventy-five percent of the people who returned the evaluation form rated the session as helpful to very helpful. People attending the sessions responded that their competency had improved based upon attending. One of the highest compliments for the seminar series was unsolicited and came from the Associate Dean of Arts and Science. He stated that the seminar series was the "best program the Computer Center had ever provided".

The seminars have resulted in increased demand for networking services and instructional computing support. Recent audiences spend less time asking about other Internet services, such as electronic mail and newsgroups, that interested earlier audiences. Instead, recent audiences are asking about how to construct web pages for the department and their courses.

The seminar series encouraged the professional growth of the librarians and the computing professionals. The librarians' use of the Internet in answering reference questions has grown from virtually no use to daily use since the beginning of these seminars. By preparing for these seminars, librarians have learned how to more effectively use the Internet. While the Internet is great for many things, the lack of quality control and source verification often makes it the last place to go for a definitive answer. Therefore, many librarians avoided the Internet. However, since the librarians began giving the Internet seminars, most of the reference librarians have turned to the Internet for answers they could not obtain elsewhere. A year ago, they would not have known how to do that. It was the training session provided by the Computer Center that provided the skills set and the need to co-teach the faculty members that provided the opportunity to use the newly acquired skills. As subject bibliographers, many of the librarians now use the Internet to read electronic journals, check other libraries' catalogs, and to stay current in the various disciplines. The librarians now provide the Computer Center with complete HTML listings for the department's resource page rather than having the Computer Center representative construct the entire page.

The computer center consultant has grown professional as well. While he continues to be a statistical consultant for the Computer Center, he now serves as Vanderbilt's Webmaster and is well respected on campus for his Internet expertise.

The seminars resulted in renewed respect and cooperation between Academic Computing and Central Library. Holding the seminars in the Central Library's classroom meant that the computer center instructor had to go over to the Library on many occasions. The librarians got to know him and feel comfortable with him. Now many of the librarians view him as their own liaison in the Computer Center. Academic Computing is no longer some vague department, it was at least two faces associated with it.

Given these seminars were so successful, it was important to understand what distinguished them from previously offered Internet training. One key difference was that the seminars were discipline-specific. They were tailored to meet faculty interests. The faculty were not simply shown a tool and left to explore the vastness of the Internet on their own instead they were given access to key resources while being shown the tool. The emphasis was on the content not the tool.

Another difference was in how the seminars were advertised. First they were announced in the Computer Center's newsletter. Then each librarian contacted the library representative to make arrangements for the seminar. Since the seminars were scheduled to accommodate faculty schedules, these seminars were more widely attended by the faculty than any other seminar series. Do not underestimate the power of accommodating a department's schedule. While we had planned initially to offer the seminars as brown bag lunches, we found that each department had its own unique time for meeting. By accommodating those times, we were able to make sure our seminars were well attended.

Distributing copies of the WWW page of discipline-specific resources also contributed to the success of the seminars. This saved the faculty the time and effort required to relocate the resources. The pages were available in Macintosh and PC format to accommodate differences in platforms.

Another way we addressed the challenge of supporting multiple platforms was by being willing to follow up on the seminar. Computing personnel were available to install and demonstrate browsers when requested. From past experience, we knew how easy it was for someone to lose their enthusiasm for a computing tool when faced with the frustration of getting it installed and working. The follow up visits and demonstrations not only saved on faculty frustration but allowed the seminar leaders to use their platform of choice and defer specific platform issues to another time.

The seminars were so successful because of the partnership of the two organizations. These seminars represent the best of both organizations. The seminars capitalized on the strengths of each organization. Central Library contributed its established departmental liaison program, in-depth knowledge of the workings of each department, knowledge of faculty interests, knowledge of content areas for the disciplines, and experience in reference techniques. Academic Computing contributed technical expertise in Internet services and resources, experience in net surfing, in-depth knowledge of campus network, and experience with regional and national networks. An added value in partnering together is that the seminar developers were able to take advantage of each other's individual strengths. There were several times when the individual strength's were different from the organizational strengths. For example, there were librarians who were well versed in the development of Internet and computer center consultants who had a thorough knowledge of a content area.

Given the enormous success of this seminar series at Vanderbilt University, the question became whether a similar program would work at other universities. Vanderbilt is a Research I (Carneige Foundation rating), medium to large size, and private university. Fortunately, we had the opportunity to introduce a similar program at Western Michigan University. Western Michigan University is a Doctoral I (Carneige Foundation rating), large, and public university. We are in the process of planning the seminar series for Western Michigan University. There are differences and similarities in the implementation of the two series.

First of all, computing support at Western Michigan University is centralized in the office of the University Computing Services which reports to the Provost. Funding for campus academic computing is from a single source in central administration: the Provost's office. These funds are allocated by University Computing Services, unlike Vanderbilt, where the individual deans are responsible for funding computing for their schools and colleges. What this has meant for the discipline-based Internet training at Western Michigan University is that the deans have been uniformly supportive of such training of their faculty, without the concern that occurred at Vanderbilt that such training would create a demand for computing which might exceed the ability of the deans to provide it from their own resources. While access to computing resources is not uniform across the disciplines and departments, the Computing Center and University Libraries can depend upon the deans to support a program of Internet training both to their own faculties and to the Provost. While it may seem basic that deans would support so manifest a "good" as Internet training, in fact their strong support promises to be important in convincing departments that such training is sufficiently valuable that departmental meeting time be devoted to it.

An important similarity that Western Michigan University shared with Vanderbilt is a lack of tradition of joint training between the Computing Center and the University Libraries. University Libraries, which is dependent upon the Computing Center for programming and network support in library automation, has enjoyed a most satisfactory relationship with the Computing Center. However, with the exception of cooperation in the development of a hypermedia presentation used for undergraduate library orientation, the Libraries and Computing Center have had little experience in joint instruction of any kind, much less instruction of the Internet. It was not until November 1993 that staff from the two organizations cooperated in a series of workshops for faculty and those dealt with multimedia and presentation software rather than the Internet. Shortly after arriving in the fall of 1993, the Dean of Libraries proposed joint discipline-specific instructional sessions regarding the Internet and gophering. The departure of the Computing Center's Internet trainer and the impending retirement of the Director of the Computing Center delayed further formal relations until the arrival of the new director of computing.

A second challenge to effective discipline-specific training -- and one shared by most institutions -- has been the uneven level of Internet expertise among librarians. University Libraries has instituted an active and successful liaison program with all the departments. Under this program a librarian is assigned liaison responsibilities, including collection development and instructional services, to one or more departments. Nearly all library faculty have liaison responsibilities. Each academic department, in turn, assigns liaison responsibilities to a member of the department. As might be expected, interest and level of activity of the liaisons vary greatly, though commitment from the library liaison is uniformly high. As was the case at Vanderbilt, when librarians offered instructional sessions for the faculty at brown bag sessions, attendance was spotty. Based on that experience and the experience of Computing Center staff's faculty development programs, we had no reason to believe that general instructional sessions in the use of the Internet would be significantly more attractive. Indeed, when these general Internet seminars were offered, attendance was low.

That experience suggested that two factors would be important in a successful instructional program for the faculty: securing a captive audience and providing specific information that faculty could use immediately using their existing computers. The Dean of Libraries had already arranged to meet with teaching faculty and their library liaisons at their regularly scheduled departmental meetings. At those meetings library collections and services were discussed and the meeting ended by the dean offering to host a subsequent departmental meeting in the library's electronic classroom. At those subsequent meetings, library liaisons were allocated the first 45 minutes or so of the meeting to instruct the faculty in the use of electronic resources and document delivery systems. While there was insufficient time to introduce Internet resources, the added value which librarians could bring to faculty research and teaching was made emphatic, even for faculty who had previously had little contact with librarians. While a few of the most sophisticated library users were a little bored, most learned something and more than a few learned a significant amount. The important advantage of this captive audience was that the librarians approached the faculty as if they were not skilled users of electronic resources and therefore, those who were, in fact, unskilled did not have to admit it. They did not have to admit a need for help, which few, if any, would have done. At the same session, library liaisons offered to provide private individual instruction at a later time. The success with the captive audience approach also paved the way for subsequent instructional seminars: these will be Internet and WWW discipline-specific.

In an effort to generate interest in the Internet and Web among administrators, librarians and computer center staff presented sessions at regularly scheduled Deans' Council. Again, this was a captive audience, this time consisting of deans, Provost, and associate provosts. A similar session was presented to the vice-presidents. Since most of these administrators did not have a command or even hands on experience with the Web at that time, the impression on them was powerful. Their strong positive response has been important in generating top-down enthusiasm for Internet training in their schools and colleges and, not the least important, for generating across the campus support for making Internet access and training a high institutional priority. The presence of both library and computing center staff at these meeting was important because the questions asked could only have been answered by staff from both organizations.

Key to successful discipline-specific Internet training are the computer center staff's knowledge of computing hardware and networking and librarians' knowledge of the Internet resources. At Western Michigan University, as we began making plans for the seminars, it became clear that a number of library liaisons who were otherwise knowledgeable of electronic resources and skilled instructors were uncomfortable with the prospect of instructing faculty regarding discipline-specific Internet surfing. A number of library faculty began expressing concern that the dean was getting too far in front of the faculty in committing to Internet instruction for specific academic departments.

In early summer 1995, the Dean of Libraries challenged the entire Library faculty, not just the liaisons, to become not simply familiar with the Internet and the Web, but expert in their use, especially in the resources which apply to the disciplines for which they had liaison responsibility. The goal was for them to become expert by the beginning of the Fall semester. In return for that commitment, librarians would receive both in-house training and external training, if they thought it necessary. In addition, they would be provided the release time necessary to acquire the expertise and practice searching and teaching techniques. The library purchased Web manuals for all library faculty. Two experienced Internet trainers from the library faculty provided the basic training and conducted laboratory exercises. Four librarians were funded to attend the Technology in Learning and Teaching workshops at Northwestern University. The dean has recognized those key librarians who have provided Internet training by making Internet instructional efforts the most important criterion in assigning administrative merit pay this year. The Library faculty met the dean's challenge enthusiastically. The result has been the integration of Internet and Web components to library instructional sessions with teaching faculty as time permits and the planning for joint discipline-specific Internet seminars with the computing center staff.

In Fall of 1995, computing center and library staff began planning the seminars with the goal of winter semester presentations. At Western Michigan University, library and computing center staff selected four departments to be the intended audience of the seminars: sociology, education (K-12), business information systems, and art. Those departments were selected because we regarded early success of the seminars to be fundamental to successful university-wide discipline-specific training. Each of the departments have the requisite level of computing and network capacity and library liaisons who are expert and experienced in Internet training. These departments also represent a broad cross section of disciplines. In addition to the roles of computing center and library staff, we expect the faculty members who are liaison to the Computing Center and to the Libraries to play an active role in the planning and implementation of the seminars. It will be important that the departments assume an active role in the seminars and share in the assurance of a positive outcome.

Cooperation between the departments, Computing Center, and Libraries is fundamental to successful discipline-specific Internet training. That is true at Vanderbilt, Western Michigan University, and virtually every other institution. At Western Michigan University, we also believe that this training should be grounded in sound academic principles. Two principles are especially important to our efforts.

The first principle is the belief that just as students find bibliographic instruction much more useful when it is are linked to specific assignments, so too is Internet training more valuable to faculty when it is linked to their specific research and instructional needs. It is through disciplinary-specific rather than general skill-based training that success is most likely to occur.

The second principle is that every student and faculty member deserves equal opportunity to become proficient at utilizing the incredibly rich resources of the Internet -- regardless of their major or discipline. We regard that as a right and not a privilege available to only those whose library and computing center staff are so motivated to provide effective Internet instruction.

We regard those principles to be sound at all institutions of higher education, regardless of size or research and instructional missions. We anticipate that the foundation of successful discipline-specific instruction will be the same at both Vanderbilt and Western Michigan University: professional expertise and commitment from computing center and library staff;

cooperation of both organizations to maximize the expertise wherever it is and to develop it where it is lacking; and support of central administration to the goal of access to the resources of the Internet and delivery of those resources.

"What I Really Want from the World Wide Web Is..." How Do We Establish Access to Ever Expanding Resources?

Rob Aken
Mary Molinaro
University of Kentucky Libraries
Lexington
Kentucky

As information providers, we are excited about the potential for delivering information to the desktop of our users in a user-friendly manner. Inevitably, as with any new technology there are many questions to resolve: search engines don't work the same as those in sophisticated databases, we now become "publishers" as well as "guides," everyone must re-tool their skills, we must rethink our realm of responsibility when our students mount their own sites, etc. In Part 1 of this discussion Rob Aken will discuss issues of Internet resources access and the librarian's role in creating, managing, and enhancing that access. In Part 2 Mary Molinaro will address issues involved in providing Internet access to users in a public setting including security, personal web pages, and providing varying levels of consultation. We welcome an open discussion of these issues following our presentation.

PROVIDING WEB ACCESS TO LIBRARY USERS

WWW sites can serve both a local clientele and a broad-based user population around the world. Excellent guides to resources abound, but they are often overwhelming to new users or users with very specific needs. Local creation of web sites permits designers to take into consideration the specific needs of their particular user groups (e.g., students and faculty in specific disciplines). Each site therefore can SELECTIVELY point to and mount appropriate resources. Researchers at other institutions who share this interest can then access this specialized data, as well.

Librarians know the idiosyncratic needs of their users and are therefore well suited to compiling this information. A structured selection process is critical to encouraging the continued use of web resources, especially since the growing size of the web makes finding relevant material difficult. Mounting unique local materials and adding pointers to specific related materials contributes a resource that saves students and researchers invaluable searching time, especially given the limitations of current WWW search engines. Most users need the libraries' resources primarily at certain critical junctures in their research, and their ability to use a sophisticated, ever-expanding resource will require all the assistance we can provide them, both via well-designed, well-maintained electronic guides and with timely training and consultation. The maintenance of pointers to resource sites is critical in this regard: sporadic users cannot hope to keep up with the changing nature of the web, but dedicated subject specialists (who analyze their subject areas continuously by searching, evaluating, organizing and presenting the material with their specific user group in mind) can and should.

The variety of user needs requires a variety of approaches: some users will take initial training and be off and running. Others will want to consult with librarians often. They may also rely on the library's ability to provide high-end machines and connectivity at a localized site. Still other users will rely on librarians to supply the material they need. End-user searching appears user-friendly to those who use a particular product often enough to get comfortable with it. The growth of the number of sites on the web, now approaching 10 million URL's, increases the need for sophisticated methods of searching, thereby making the use of the resource, even one as easy to use as a web browser, more difficult for periodic and new users. Lycos, for example, plans to add field and code searching, and while on the surface that suggests ease in finding more relevant results, it will often extend the learning curve and not be that useful to users who enter one search term and browse the resulting hits to determine the relevancy level themselves). The one constant, of course, of all users is the need to find information as quickly as possible so they can apply it to their work in progress; what librarians bring to this process is the efficiency that comes with experience with information resources and the application of appropriate strategies to filter resources so that the most relevant are available.

Various approaches are being considered for making material more easy to find and access. The OCLC Internet Cataloging Project will help libraries provide users with a way to discover Internet materials using a structured, familiar resource (their own online catalogs) access them from the same workstation. This single gateway approach is one of the prime advantages of the web, something users have been seeking ever since electronic resources starting appearing in libraries. Introducing this material into the online catalog is particularly critical at this point in the development of the web because what a user wants is often there, but they don't know how to find it or even think to look there for it.

Librarians are also starting to provide descriptive information and evaluative analysis of tools on the web (see, for example, Roy Tennant's Internet Search Tool Details on the UC Berkeley Library web site http://www.lib.berkeley.edu/Help/searchdetails.html). We can also keep users informed of new resources on a structured, regularized schedule (as we've done for years, for example, with Selective Dissemination of Information searches; Lycos plans to introduce a current awareness service in the near future). And there is a need for evaluating and introducing new search and access tools.

Archiving materials is also necessary; useful collaborations between librarians, computing personnel and information providers are occurring to this end. We should develop electronic repositories encoded for precise access, taking care to designate duplicates and versions, maintaining stable and error-free materials, and establishing authority control for uniform access.

Critical to SCHOLARLY research will be the commitment on the part of resource providers to ascertain the reliability of the material as well as its availability. Librarians must work with technical support personnel as well as the publishing world to guarantee the value of the WWW as a scholarly tool. It is likely access to much of this scholarly material will be fee-based, and libraries will need to work with producers to find distributed cost alternatives that provide access to their constituency. Mirroring of heavily-used sites can contribute to access reliability.

PROVIDING WEB SERVICES IN PUBLIC FACILITIES

With the explosion of the World Wide Web use on campus, click and go browsers such as Netscape present a host of challenges to those providing access in public facilities. While an integration of internet services such as mail and netnews into a single browser is a blessing for a machine on one's desk, in a public facility with open easy access this open access can create havoc.

While Netscape gives the user the ability to post mail and to submit forms to web sites around the internet, the only requirement is that one's mail address be set in the browser's preferences file. The difficulties arise because the user can input any address -- real or fabricated. This unauthenticated mail access is clearly a violation of campus computer security policies and internet regulations, but is extremely difficult to control. System administrators can even go so far as to eliminate mail access from the browsers loaded on all public machines, but there is nothing to prevent users from downloading fresh copies over the internet, configuring the preference files and then sending mail at will.

World Wide Web services have become so accessible that users are now easily able to publish their own information on the Web. Since it is so easy for users to create their own web pages it is natural that they want them to be attached to a web server for public consumption. The more savvy computer users can create their own servers within their accounts while the less able pressure the local system administrators for public space for their work. Several questions arise from these scenarios. Do system administrators spend time hunting down and eliminating unauthorized web servers or is it better to provide space for users to publish on the web? If administrators provide the facility for users to mount web site is the university responsible for content? The material is after all gaining access on university owned and operated equipment.

As technology is better integrated into the classroom and the World Wide Web is being used more as an instructional tool, who is charged with maintaining the sites that are created? Since the sites are world readable and these sites project a certain image of the university is the university responsible for monitoring the content, for safeguarding the accuracy of the information or the "look and feel" of the information?

Providing good service to users becomes increasingly difficult as applications become more diverse and more powerful. There are so many different web browsers with a such a variety of functions that providing service and support for each one are difficult. Users can use browsers with a graphical user interface or one that is text-based; a browser that supports forms or one that does not; a browser that functions one way today and another version that functions differently tomorrow. The computing environment is changing so rapidly that providing consistent support is nearly impossible to accomplish successfully.

Accessing user needs and abilities is also difficult. New users and experienced users will have varying levels of needed assistance. Consultants in public facilities must be able to assess users' abilities and needs to answer their questions appropriately.

Many faculty members are now requiring students to use internet services to find information and to submit assignments electronically. It is not uncommon for faculty to assume either that students already have the internet skills needed to complete the assignments or that the consultants in the public labs will provide the needed instruction.

The new technologies are allowing us to teach in ways never imaginable two decades ago. Students are now better able to communicate with the faculty and with each other. Collaborative projects are now possible using various software packages or the World Wide Web. While providing service and support in a rapidly changing environment to a clientele with ever expanding expectations is challenging, the overall benefits to the educational process make it worth the effort. Instructional technology is providing the foundation for an information literate student body that will be better able to compete in tomorrow's society.

LIBRARY AS PERPETUAL PARTNER: PROVIDING INFORMATION ACCESS AND TECHNOLOGY SUPPORT

Benjamin A. Shepherd, Vice Chancellor for Academic
Affairs and Provost

Carolyn A. Snyder, Dean of Library Affairs

Jay Starratt, Director of Technical and Automation
Services

Southern Illinois University at Carbondale

Carbondale

Illinois

The library as a perpetual partner in providing services and technology for Academic Affairs is described by the Vice Chancellor for Academic Affairs, the Dean of Library Affairs and the Library Director of Technical and Automation Services. The collaboration includes campus partnerships in Academic Affairs and with other areas of the university such as Information Technology. State, regional and national cooperative endeavors in which the University is engaged to meet the service mission of the library will be discussed. A videotape which provides an overview of some of the partnerships is part of the presentation, and copies are available upon request.

Vice Chancellor for Academic Affairs and Provost

My colleagues and I appreciate the opportunity to share with you some of our accomplishments and how they have been achieved, in the areas of technology support and, providing access to information. Excellence in these areas is necessary to sustain and enhance Southern Illinois University at Carbondale's (SIUC) mission of teaching, research and service.

As is surely the case with each of you, we are finding that information access, which comprehends technology support, is a principal limiting factor on our ability to remain competitive, as well as to meet the needs of our faculty and student user populations.

The limiting factor on information access of course, is "scarce resources." We have calculated that to meet our technology "wish-list" needs, SIUC would have to win the Illinois lottery when the lottery reaches the $140 million mark. This mind-boggling number is an estimate of what would be required to: connect all of our buildings with fiber optics; renovate and install wiring closets; and purchase the necessary hardware and software to complete our transition from a mainframe environment to a distributed, client-server model.

As a state-supported institution, the Illinois Purchasing Act does not allow us to either budget for or purchase lottery tickets; hence, we are having to find other means to incrementally fund a much-scaled down list of highest priorities. I am finding that even the process of identifying the highest of the high priorities is a challenge, and the increasing demands for an ever-growing list of services by the user populations combine to form a chorus that may be likened to the Preservation Hall Jazz Band playing counter-point!

To give you some perspective of our University, SIUC is a Carnegie II Research Campus with approximately 23 thousand students and 900 full-time faculty. We have nine undergraduate colleges, a School of Law, a School of Medicine and a Graduate School. At the center of these instructional and research units is the library, which holds memberships in the Association of Research Libraries and the Center for Research Libraries. In addition to meeting the undergraduate instructional needs, the library serves the graduate education and research needs of 57 masters programs and 27 doctoral programs. Our external grant and contract activity is roughly $65 million; $20 million of which is from federal sources, largely to support research.

Approximately 80% of the state appropriated budget for the Campus is allocated to Academic Affairs. Structurally, the instructional and research units except for the School of Medicine report to the Academic Vice Chancellor, as well as do the Library, Admissions and Records, and the Broadcasting Services. A separately budgeted administrative unit titled Information Resources reports to an Executive Director for Information Resources outside of Academic Affairs. Information Resources is responsible for telephone services, central administrative computing, and the basic technology infrastructure needs of the Campus and includes Information Technology which interfaces with the library. From my view as Vice Chancellor for Academic Affairs, Information Technology is a high potential ally and partner for Academic Affairs, and the library in particular, to join forces to meet the information needs of the instructional and research user populations.

In order for this potential to be realized, cooperation and open communication had to be the rule, partnerships had to be forged, and strategies developed. The federation of players included the Executive Director of Information Resources, an informed Library Dean with a vision, and the Vice Chancellor for Academic Affairs. The Dean of the Library was fortunate to have a first-rate staff, and it has been my good fortune to have maintained open communication and cooperation with the Executive Director of Information Resources. As a result, we have been able to engage a partnership between the library and Information Technology which leverages scarce resources to better meet user information needs. Other benefits of the partnership have included: 1) decreasing cost; 2) taking advantage of complementary expertise within Library Affairs and Information Technology to increase the scope of services delivered; and 3) collectively identifying priorities which have the highest return on investment.

At the core of the Library/Information Technology partnership is a functional team of professionals from both units, which supports the Campus Wide Information System. This CIRCA 2001 Team is the glue which holds the partnership together, and which has contributed greatly to the expansion of information services and technology support to users in a resource-limited environment. I should hasten to add that neither the CIRCA 2001 Team nor the cooperation between units has diminished the challenge to the library for increased services, and additional products and applications. Balancing the resources to meet user needs across the faculty and student populations falls on the shoulders of the Dean of Library Affairs.

Our instructional program mix and strategic geographical location in the state of Illinois have had an impact on our technology initiatives. Our service area is the southern one-third of the state, and the Illinois Board of Higher Education which is the higher education coordinating board has charged SIUC with giving leadership to the statewide, telecommunication network for downstate Illinois. This places us at the center of two regional consortia, Southwest Illinois Higher Education Consortium and the Southern Illinois Collegiate Common Market each headed by a Director, who works closely with the nine respective Community College Presidents, the two University Chancellors and the SIUC Library Dean in particular. Together, we partner to provide a between-and-within telecommunications network and technology infrastructure on the Campuses to meet the growing Distance Learning needs of the region. The library serves as the macro-interface between our Information Resources and the consortia members, and participates in scheduling and maintenance of the supporting technology infrastructure.

SIUC is committed to fully exploiting the incorporation of technology into the instructional process, to improve teaching and learning. Evidence continues to mount which suggests that creative infusion of technology into the delivery of content to students, at least in some disciplines, results in superior achievement by the students when compared with traditional pedagogical methods. Mastery of content in Mathematics and Computer Science by students in Arizona and Oregon strongly suggests that by using technology to supplement delivery of the material, student performance is increased and cost is decreased. I am not advocating that the so-called "talking heads" can or will be replaced by technology; rather, I am acknowledging that compelling cases are surfacing which demonstrate that the infusion of technology into teaching and learning, can enhance student comprehension, and increase pass rates and student retention. The litmus test for the effectiveness of technology in the delivery of content has to be student comprehension. Cost is also an important parameter but is secondary. At SIUC, our first concern is to improve the quality of the undergraduate instructional enterprise campus-wide through the use of technology as a supplemental teaching tool. We believe that technology has the potential to not only enhance comprehension of focused content, it can also allow the learner to build on the content by accessing a virtual knowledge base independent of the instructor.

The greatest on-going investment of resources on the Campus is in personnel, and the faculty is the knowledge disseminating and generating machine which drives teaching and research. This means that faculty expertise must be matched with the power and capability which technology may afford if the Campus is to take maximum advantage of both resources. Many of our faculty are not trained in the use of technology to improve their productivity in the classroom and laboratory, and others are dubious that the use of technology can make a positive difference. This inertia must be overcome, and the library is a central, potential change agent to recruit, train, and provide continuing support to faculty, as they make use of technology to increase productivity, as well as increase quality.

Last March, our Campus was selected as one of 52 new media centers nationwide. The cost benefits realized from this designation will allow the Campus to accelerate development of multimedia products and incorporate them into the instructional process. Our multimedia initiative to be successful must be program driven, and to ensure that the program drives technology rather than vice versa, we are seeking an M.A. degree in Multimedia. This degree program will be structurally located in our College of Mass Communication and Media Arts which already houses degree programs in Radio and Television and our Broadcasting Services composed of two TV stations and two radio stations. However, the partners charged with making the multimedia effort a success include the Library, the College of Mass Communication and Media Arts, and the College of Liberal Arts. This three-way partnership is in every way complementary, leveraging existing investments in personnel and in technology to launch an on-going degree program which will produce quality graduates, train faculty in the use of technology, and research, develop and assess multimedia instructional products which can be used to enhance the quality of instruction on Campus, as well as produce quality, Distance Learning course formats.

As you can see, we have devoted considerable effort to forging on-campus partnerships which we believe will increase productivity and cut costs. We see the library as a critical player in our efforts to accelerate the effective incorporation of technology into the teaching and learning process, without compromising its traditional roles as information access provider and instructional support partner.

Dean Carolyn Snyder will now share with you the Dean's perspective on how well we are meeting our challenges.

Dean of Library Affairs

My comments will focus on the library's role and goals as a perpetual partner on campus in both the state and the region. The academic technology leadership position that the library holds on campus was established and encouraged by Provost Shepherd and the Chancellor when I was appointed at Southern Illinois University at Carbondale (SIUC) four years ago. The library plays a key role in projects that bring together individuals from units such as Information Technology, Broadcasting Services, the colleges and the regional higher education consortia.

Library Affairs is a unit of Academic Affairs. As the Dean, of Library Affairs, I report directly to Provost Shepherd and am a member of Deans' Council. All of our library activities are based on our mission: "to support the current and anticipated instructional, research, and service needs of Southern Illinois University at Carbondale. Library Affairs will strive to serve the citizens of the state and scholars of the nation and world. Library Affairs will assume a leadership role in providing intellectual, bibliographic, instructional, and physical access to information resources. Service to users is the first priority of the library." To reiterate, the library is a service organization for our faculty, students, staff and other users. The SIUC library has broader campus technology responsibilities than some of the other major research libraries. In addition to the usual range of library and information services, the SIUC library has responsibility for:

1. Distance Learning coordination and Distance Learning technical, network, and instructional support. (Distance Learning is defined as the utilization of interactive video to deliver courses.)
2. Other Instructional Support Services including instructional development, instructional evaluation, video production, multimedia and other instructional technology, and classroom equipment support.
3. The Ulysses S. Grant Association, an editorial project.

In the context of the campus environment described by Provost Shepherd, relevant operational objectives of Library Affairs include:

1. Providing high quality services and maintaining efficient and effective operations.
2. Increasing and enhancing services to users.
3. Increasing library and information resources and services available to locations outside the library, including offices and homes.
4. Accomplishing this in an environment of serious staffing and budget limitations (even though the library has received special consideration for the limited funding available).
5. Reviewing on an ongoing basis resource allocations and appropriate reallocations to meet the highest priorities.
6. Providing ongoing programs of education and training for library users and library staff.
7. Broad sharing of information among library staff in all types of appointments. For example, a graduate assistant may be the expert for a particular software application.

The assets of Library Affairs include:

1. University administrative support and understanding of our challenges.

2. Excellent, creative and dedicated library faculty and staff.
3. A library leadership team which is committed to plan and implement new technologies and services for our users. This team is willing to change, to learn, to take some risks and is enthusiastic about technology.
4. A tradition of partnerships and networks, such as our leadership in resource sharing/interlibrary loan in the state, the region and the nation.

However, even with these assets, we have been challenged by the range and diversity of opportunities for providing excellent services and resources to the entire academic community. Therefore our new and evolving partnerships are essential to meet our service goals.

The most basic and long-standing partnership of this library and most research libraries is with the faculty and students of the campus. The faculty and staff of the SIUC library have a broad understanding of the teaching, research and service activities of the university because of their long history of collaboration with the faculty to build the library collections and because of their provision of library services. This partnership was strengthened two years ago with the implementation of the library's Liaison Program, the assignment of a library faculty member to work with each of the some sixty academic departments on campus to meet their library and information resource and service needs.

In the last four years, the library has also formed other strong and special partnerships to meet the needs of our users. With limited staffing and fiscal resources, this collaboration and sharing of staff resources has been essential. Our partnerships, which I will describe only briefly because they are illustrated in the video, include:

1. CIRCA/2001 Team: A partnership with Information Technology which was established in 1992 to establish, maintain, and expand the CWIS, Campus-Wide Information System.
2. Campus CIRCA/2001 Group: A user group led by Library Affairs and Information Technology which includes representatives from many academic and support areas. It meets once a month for information sharing and demonstrations.
3. Geographic Information Systems (GIS): A group of campus users who formally and informally share information and resources.
4. Instructional Support Services: A wide range of projects in instructional development, video production, multimedia and other instructional technology developments involving many partnerships with individual faculty members and others involved in the instructional process.

5. Distance Learning: Multiple partnerships on campus and in the region.
6. Digital Imaging Unit: A number of collaborative activities including the University Press/University Library projects begun as one of the original Coalition for Networked Information/American Association of University Presses projects.
7. Athletics: The fifth year of partnerships with both the men's basketball team and the Student Recreation Center in publicizing our joint activities through fund raising events.

We have available an eleven minute videotape produced totally within the library. This videotape, produced to update the campus about Library Affairs, describes and illustrates some of our technology partnerships. Our colleague, Jay Starratt, had primary responsibility for writing the script and overseeing the production. Copies of "The Library And Technology Partnerships" are available for loan from Carolyn Snyder.

Director of Technical and Automation Services

My part of this presentation is to describe the benefits and challenges associated with working in these numerous and varied partnerships, and to explain what the day to day enterprise entails.

I should first say that the benefits of working together far outweigh any drawbacks. For every instance of small annoyance and frustration, there are scores of moments where there is a sense of real accomplishment and urgent enthusiasm.

Without a doubt the primary benefit of our cooperative efforts is improved campus-wide communication about technology initiatives. I cannot overestimate the value of the fact that through various formal and informal alliances formed over the past few years, across the campus, people working on aspects of information on instructional technology have gotten to know each other. Such familiarity breeds respect.

It is valuable for the people in the colleges to know what the library and the Information Technology staff are doing. It is equally vital that they have an opportunity to help us in our developments and for us to know what their priorities are. When people are informed, they are usually supportive.

This sharing of information moves easily into sharing of expertise. With quick and easy communication, what one person learns, we all become aware of or can learn without the struggle of being the first to learn. Indeed in many cases, the first to learn becomes everyone's resident resource, no matter where they actually reside.

Sometimes, sharing of staff expertise can lead to sharing costs, as when the Geography Department helps support a graduate assistant in the library's Geographic Information Systems (GIS) unit.

Again, sharing of expertise moves easily into sharing services, facilities and equipment. Not every one has to own every thing if they are fairly confident that they can avail themselves of a service or piece of equipment easily and without hassle. The proof of this benefit is that a number of colleges have helped the library purchase equipment or software, but let it reside in the library. We all can stretch our funds that way.

As this illustration shows, the partnerships build trust. We give each other the benefit of the doubt and we don't look too deeply for camouflaged agendas. As the technology experts in a college come to trust us, so do the others in the college.

Perhaps the greatest benefit is that of the simple awareness for the library and for the Information Technology staff of the conditions throughout the university. Sometimes we get used to rarefied atmosphere where everyone is well equipped and well trained. Our conversations with our colleagues can bring us back to earth.

The challenges of our partnerships are the same as with any groups working together, but I have to say that our conflicts are minimal because of the enthusiasm we all share for the work.

Our biggest challenge lies in the fact that the library staff is at the crossroads of everyone's highest priority project. It is occasionally difficult to have everyone keep an appropriate perspective on their key projects. Needless to say, these partnerships not only allow for better communication, they demand it.

The coordination of all the people and projects can be a challenge when the people are working in different units. It is especially difficult among a group notoriously disdainful of meetings, most notable about general meetings. The Head of the CWIS Team and I get a lot of good natured abuse when we call big meetings for the purpose of information sharing. We have many "Dilbert" fans in our groups. But if we rely too much on the informal, we drift apart and surprises start to pop up.

Ongoing support for the projects we help our partners develop is another challenge for which we don't have a miracle cure - development is just more fun. Fortunately, the various campus units are adding technical staff at a steady rate.

This expansion of staff has also meant that we must pay closer attention to protocol. It may surprise you to know that there are some people who act without the authorization of their units. We must always be careful not to overstep our bounds and trod on someone's toes, while still maintaining an approachable front.

It is a challenge to keep all the balls in the air; to keep every one committed and enthused; to keep everyone in the same book, if not on the same page, but it is well worth it, especially for our users.

The last thing I am supposed to talk about are future initiatives. To be honest, I had hoped I would be able to say "but since our time is almost up and we need to have a period for questions, I will just stop here and open up the floor to questions," because I have developed a legendary status about being wrong about predicting future initiatives. I only know that future initiatives will come from out of left field and will overwhelm us with their urgencies.

(January 4, 1996, CAS)

Distributed Academic Technologies: Changing the Face of Teaching, Learning and Research

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Kent State University, an eight campus system serving nearly 32,000 students, is engaged in a strategic planning process in collaboration with the IBM Corporation, to define and implement technological initiatives that facilitate the development of an interactive high performance learning environment -- an environment that is more learner-centered with self-paced instructional multimedia courses that can be distributed to students anytime and anyplace. The objective of this paper is to share the rationale, goals, objectives, benefits and critical success initiatives developed during the planning process. The paper will also address the pilot distributed learning projects that are currently underway, as well as the vendor partnerships being established to support the distributed learning effort.

RATIONALE

The spectacular proliferation and integration of computers and networks have fueled the creation of a global information environment -- an environment that allows people to share information and collaborate on projects from any place on the globe. This "information age" is touching every aspect of our lives, especially the ways in which we teach and learn. It promises to extend the boundaries of education beyond the walls of institutions into the community and beyond -- into schools, homes, businesses, etc.

Kent State University, like most universities, is facing an enormous challenge -- how to acquire and integrate the technologies of the information age, and develop the interactive high-performance learning environment that will take it into the next century. The "learner-centered" environment that Kent is creating focuses on integrating distance education and multimedia technologies, and includes self-paced instructional multimedia courses capable of being delivered "just-in-time" to students anytime and anyplace.

This paper reviews some of the key issues associated with Kent's progress in meeting the challenge mentioned above and describes the goals, objectives, benefits/impact, and implementation approach being taken to move into a high performance learning environment.

GOALS

Persistent technological change along with budgetary constraints create major challenges for Kent State University to meet the technological needs of its academic sector. The Kent Self-Study Report for North-Central Accreditation notes that the university continues to allocate an ever-greater proportion of its resources to computing in an effort to improve its networking, instructional delivery and information systems. Kent is in the process of constructing a Kent Campus fiber-optic network, as well as links to each of its seven regional campuses. Kent's Strategic Plan states that the University should continue to "enhance access, teaching, and learning by utilizing state-of-the-art instructional and communication technologies." The efforts to enhance Kent's technological infrastructure support its desire to strengthen support for technological initiatives throughout the university system as well as to expand access to information sources, educational opportunities and communication networks for all students and faculty without regard to time or place.

The following specific goals for Kent include:

* growth of discipline-specific hardware and software adequate to support student and faculty educational endeavors;
* standardization of general computer applications such as word processing, spreadsheets, and database management;
* consistent access to well-equipped and staffed computer labs;
* support of electronic or multimedia classrooms that house a selected set of technologies that enhance instructional capabilities through a

variety of methodologies and resources;

* requirements and opportunities for students, staff and faculty to achieve technological competency;
* student and faculty access to library and other information resources, including text and graphics, whether they are located on a specific campus, across the nation, or around the world;
* real time conferencing involving multiple users such as faculty and students, interacting at an informal conversational level;
* collaborative research projects and routine group work by teams through the use of common tools such as spreadsheets, graphic representations, tables and mathematical equations;
* the integration of administrative data into the instructional process, thus contributing to faculty and staff effectiveness through improved timely access to needed information for purposes such as student advising;
* the study of information flow and re-engineering of work processes to reduce manual procedures and paper flow is needed.

Three specific actions relate to the above goals: 1)Kent is systematically developing multimedia, distance and distributed learning courses to be initially disseminated using high speed network connections among Kent's eight campuses. Three courses are being developed in phase one of an ongoing effort to create and offer multimedia courses and workshops distributed over computer networks throughout the Kent State University system, as well as to corporate sites in the region. A team approach to course building includes faculty participants as well as library, media and computer services staff working with corporate and other university partners. 2) Kent is in the process of establishing a technologies and learning center with facilities and programs to support a broad range of teaching and learning systems that serve faculty and students and community members who have differing technological capabilities, learning styles and needs. 3) Research on the effective and efficient use of integrated distance learning and multimedia technologies by faculty and students in multiple, teaching, learning and research environments is being emphasized through written documentation of project development and evaluation of the multimedia/distributed learning courses currently under development.

KEY OBJECTIVES

Kent recognizes that a University wide network is a required utility (like water or heat) for the survival of a modern university. The network has to be ubiquitous, reliable and provide adequate capacity to support voice, data and interactive video communications. The existing network plan, completed in September 1992, provides the University with a realistic blueprint for a campus wide backbone. In order to provide for interactive video, the plan includes the installation of single-mode fiber to support the establishment of fully mediated classrooms and distributed learning programs. By the spring of 1996, the backbone will be complete.

In addition, a technologies and learning center is being developed on the

Kent campus to serve all eight Kent State University campuses. Moulton Hall, built in 1917 and listed with the National Register of Historic Place, will undergo a physical transformation to serve as the hub of technology initiatives for the University. This hub, to open in the fall of 1997, will:

* create an environment in which faculty can research, design and test how technologies can bring about more effective teaching and learning -- both face-to-face and over great distances.

* offer technologies and new techniques to a broader constituency and train that constituency in their use.

* act as an information distribution and management center and a resource center for the educational community.

* facilitate work with other universities and corporate partners to develop and disseminate "learner-centered" courses utilizing today's new technologies.

* support the establishment of a variety of technology-rich master classrooms.

* provide classroom observation facilities to support and enhance research.

* include an academic technologies software library and laptop computer loan center.

* provide a presentation and conference facility designed for teleconferencing.

* create direct linkages to Ohio 100,000 K-12 classrooms through Ohio's SchoolNet initiative and to business and community organizations.

BENEFITS/IMPACT

The impact of the multimedia/distributed learning initiatives being put into place will be on people, the places where they will earn, and the learning strategies they will use through the use of technology.

For students, multimedia/distributed learning initiatives will provide a comprehensive approach to disciplines that are not time or place bound, i.e. that link students with teachers, resources and other student across campuses as well as across the world; an all-encompassing view of disciplines using all appropriate media; a versatile technological platform for the classroom, from which professors can draw to make sophisticated observations of their own, thereby sharing their own expertise more effectively with students; an easy-to use "second voice" available 24 hours a day, 365 days of the year in dorms, at home, in other classroom buildings, in a format that allows students to move at their own pace, regardless of their educational backgrounds; connections for global teams of students who can learn and do research together; a computerized record of the student's intellectual odyssey.

For faculty, multimedia/distributed learning initiatives will provide the impetus for restructured courses, curriculums and teaching methods that take advantage of multimedia technologies; shared research, instructional activities and equipment with the multiple campuses of Kent State University and other universities, by removing the boundaries of time and space; new interdisciplinary research and teaching connections between universities through the use of electronically networked resources; a new research agenda related to qualitative and quantitative improvements in education through the use of information and multimedia technology; new partnerships with industry, government and primary and secondary schools through the use of the information infrastructure; and consulting opportunities in the area of technology and multimedia applications.

For the community, multimedia/distributed learning offerings will enhance the easy and regular flow of communication and ideas, that have the capacity to bring Kent and its communities closer together; apply expert knowledge originating at Kent to community problems or objectives through the use of technology; provide greater opportunity for collaboration between the university and its surrounding communities.

IMPLEMENTATION APPROACH

Solutions to the technological challenges facing the University lie in the ability of the University community to articulate clearly the options and resource requirements for multimedia/distributed learning initiatives. The logical assignment of responsibilities for meeting needs and the establishment of a well-defined balance of effort between central and distributed information systems and services is now being determined and implemented. Much work will be required before the next century to meet the particular information technology needs of each discipline. This will necessitate a major realignment of allocations across all sectors of the University to achieve noticeable progress and positive change in instructional processes.

A faculty advisory committee to participate in the development of program requirements for an academic technologies and learning center (Moulton Hall), was established in 1994. This was followed by the development of four "cross functional" teams made up of faculty and staff, to determine the direction of all multimedia/distributed learning initiatives at the University. These teams advise in the areas of 1)technology infrastructure and networking; 2) faculty and student support; 3) policy; and 4) grants and funding. All teams have been meeting regularly since May of 1995 to help articulate the vision for transforming education through the use of technology, as well as further defining program requirements in real terms, i.e. policies needed to support multimedia/distributed learning options;

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equipment and training needed by faculty, staff and students to work in this new environment; the technological infrastructure needed to distribute courses over computer networks; as well as the funds needed to carry various projects forward as well as sources of support. Over 60 faculty and staff from all campuses of the University are involved in the deliberations of these committees.

In addition, Kent's multimedia/distributed learning initiatives are presenting a unique opportunity for the University to establish mutually beneficial partnerships with individuals, other educational institutions, private corporations, governmental agencies and others. By pooling resources and working as teams, partners are participating in developing asynchronous models of instruction that use the national information infrastructure, and interactive multimedia and distributed learning technologies. This collaborative effort is providing a model of joint planning and implementation between public and private organizations that would be difficult, if not impossible, to accomplish independently.

Partners are having the option to support a series of distributed learning pilot projects; helping to determine the best solutions for implementing Kent's eight-campus technological infrastructure; advancing specific educational and commercial agendas; or most important, helping to create the Moulton Hall Technologies and Learning Center.

All of these efforts are leading to the development of an action and project assessment plan to include the following critical success factors:vision and leadership; program definition, consensus and support, funding, training and support, quality management, visibility and public relations, facilities and policy review. Documentation of these factors is an ongoing part of the pilot project now under way.

PILOT PROJECT

Pilot 1, being completed in partnership with the IBM Corporation, is part of the Moulton Hall Technologies and Learning Center effort. It is the first of four such pilot efforts intended to build courses and workshops that will be able to take advantage of the capabilities of Moulton Hall from its initial availability. It is comprised of three separate courses which are being built to be delivered in a PC based distributed interactive multimedia environment. Pilot 1 includes development of three courses: a senior level course in Nursing, a junior level course in English and a graduate level course in Business Administration. A major benefit of the Pilot approach is the opportunity to determine problems in a controllable environment. It is also providing the opportunity to determine the true parameters of the enterprise and to make adjustments and changes as needed, from technical, logistical and policy points of view before a large number of courses are distributed over a wide area. It is helping faculty to understand what is involved in working in this new environment and promoting faculty buy-in for the distributed learning effort.

Goals of Pilot 1 include: increasing student access to education without regard for time and place; increasing teaching tools available to faculty by validating the multimedia/distributed learning model. Objectives following from these goals include: evaluating the effectiveness of the distributed learning medium and determining what works best for both faculty and students; determining a workable course development process for Kent; integrating new uses of digital technology in the classroom environment; building digital PC based interactive multimedia courses for distribution among Kent's eight campuses; and determining a viable technical architectures to support multimedia/distributed learning courses.

Pilot 1 courses are being developed by teams of faculty and technical support staff who are "building" courses, with the aid of staff skilled in graphic design, film production and information technology systems. Formal documentation of the process underway is providing a summary or problems and issues, both technical and policy, as well as a record of how each is resolved. Documentation of repeatable processes is also underway.

Major steps in pilot course development include the following: initial course design, supported by syllabus development; training in the use of multimedia development software for both faculty and staff; facilitated story board sessions to "draw" screen images and determine appropriate multimedia content; development of new multimedia content as needed (custom video, audio, animation, graphics, photos); module (course unit) construction; testing (student "try-out" of modules); revision based on student feedback; testing of technical environment; and evaluation of teaching/learning effectiveness. The first two courses are scheduled to be offered in the spring of 1996; the third course is scheduled for the fall of 1996.

Four pilot cycles are planned before the opening of Moulton Hall; the building is scheduled for opening in the fall of 1997. Each cycle will test the use of technology, software and design applications, and establish a level of expertise by the support staff which can be carried over into courses developed within the Moulton Hall environment.

BENEFITS

There are several overarching benefits to the University that are likely to come from supporting multimedia/distributed learning initiatives. They include: improved motivation, retention, and satisfaction of students; students who are better prepared for their careers; graduates who are more competitive in the marketplace; students who are better prepared to live and work in the computer and information age; an improved placement record for University graduates; improved instructional techniques based on multimedia/distributed learning models; enhanced student, faculty and staff productivity; improved faculty research competitiveness; and an improved image for the University.

In addition, the establishment of Moulton Hall as a center for multimedia and distributed learning technology will support an increase in the quality and efficiency of instruction. Students will receive more hands-on instruction, resulting in an improved learning experience. When students see computers and related technology used effectively, they can develop better models for their own computer use. Computers will also be more widely used in a variety of classroom settings. Faculty will also be in a better position to use multimedia technologies to enhance the learning process. They will have added incentives to invest their time in innovative approaches to computer-based teaching. In addition, they will face fewer difficulties and have staff and technical support for their attempts to use new technologies for teaching.

Distributed learning initiatives will make it possible for students to participate in classes offered at any of Kent's eight campuses without regard to their campus of residence. They will be able to work together and with teams of students from institutions other than Kent without having to come together in the same physical space. Northeastern Ohio will have immediate off-campus access to the technological and educational expertise of Kent faculty. Corporate executives will be able to collaborate with Kent faculty in teaching employees at remote sites. Business and community members will have both on-site and remote access to distributed education and training programs and be able to test new software, and receive training on new technological applications. School districts and classrooms, through Ohio's SchoolNet program and from around the world, will have access to interactive distributed education and training programs.

CONCLUSION

Multimedia/distributed learning technologies are not the proper mode for all faculty or all students. Faculty must feel comfortable with the technology, must genuinely enjoy spirited interaction in a distributed mode and "expect the unexpected" to happen, both with the technology itself and with students as they learn in this environment. In addition, though there is the expectation that students will like this medium of learning better than that of traditional courses, some may drop out or may dislike it very strongly.

Multimedia/distributed learning technologies support additional methodologies for teaching and learning, not substitutions for those that currently exist. As a force for enriching the teaching/learning environment, multimedia/distributed learning technologies offer a set of tools, strengths and limitations which are available to an instructor for delivering course materials and structuring learning experiences. Kent is currently focusing on the strategic use of such technologies to address critical issues in instruction and education. It is currently demonstrating how existing multimedia development tools can be enhanced to support the creation of multimedia courseware in a distributed mode and in so doing create more learner-centered applications. The move to Moulton Hall will allow Kent to broaden its focus to explore new models of distributed learning and the use of instructional and technological systems which enable them. Kent's ability to define new teaching and learning models based on technology is strategically tied to an understanding and deployment of distributed technologies and learning environments created in the pilot project process.

This paper has summarized the rationale, goals, objectives, benefits and critical success initiatives identified to move distributed learning/multimedia initiatives forward at Kent State University. Kent is continuing to identify new interests and goals of faculty who wish to work in this environment. Through an ongoing pilot project effort, Kent hopes to deepen its understanding of distributed learning and provide value to the higher education community as well. Through presentations at CAUSE and other national conferences, the Kent experience can be shared with others in the higher education community. By this means developments at Kent can be brought to bear on the national dialogue regarding the strategic use of multimedia/distributed learning technologies in education.

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Computing Center/Library Cooperation in the Development of a Major University Service: Northwestern's Electronic Reserve System

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ABSTRACT

The design and implementation of a network-based document distribution service within a university entails careful planning, considerable communication, and coordinated action between computing center and library staffs. Northwestern University's experience in developing an Electronic Reserve System (ERS) offers a case study of the several elements requiring coordination, including software distribution, system design, the recruitment of faculty for testing and early implementation, and evaluation. This review of Northwestern's ERS highlights how coordination between the two organizations was accomplished, what conflicts were faced and how they were resolved, and how ongoing development of this successful service is being managed. A number of useful insights into organizational roles and boundaries have emerged from this experience, offering a perspective on the relationships between service offerings of library and computing center organizations and how such offerings might change in the future.

Computing Center/Library Cooperation in the Development of a Major University Service: Northwestern's Electronic Reserve System

INTRODUCTION

Although libraries and academic computing organizations both seek to support research, teaching, and learning on campus, they often conceive of and develop services in isolation from one another. This tendency to operate in isolation may arise from differences in organizational culture, varied levels of technical expertise, or turf issues. The isolated approaches may also be due to the simple fact that people in each of the two organizations just don't know what people in the other organization are doing or are supposed to be doing. Regardless of the reason, this style of operation often results in competing services, or services whose availability is confined to one set of facilities, does not serve users well, and does not scale well. Instead, when libraries and academic computing organizations collaborate, they can design and deliver services which effectively meet user needs and advance research, teaching, and learning.

Northwestern University's experience in developing an Electronic Reserve System offers a case study of collaboration between academic computing and library organizations. The design and implementation of this network-based document distribution service entailed careful planning, considerable communication, and coordinated action between computing center and library staffs. A number of useful insights into organizational roles and boundaries have emerged from this experience, offering some perspective on the relationships between service offerings of library and academic computing organizations and how such offerings may change in the future.

The goals of the two organizations in developing an electronic document delivery service were not identical, but were complementary. What could have been competing goals — actually political jockeying for administrators' attention and resources as both organizations sought to exploit what the economist and organizational theorist Anthony Downs has called policy space created by a new technology gap[1] — were organizational objectives which were articulated with each other so as to drive both units toward the creation of a system with dimensions larger than either could have carried out on its own. There *were* conflicts, of course, but they were resolved through give-and-take as both organizations saw advantage in moving forward rather than letting the work stall.

This paper reviews the recent historical development of Northwestern University's Electronic Reserve System and describes the system's components, functionality, and interim evaluation. A further goal the paper strives for is to offer some perspective on how academic computing organizations and research libraries might better recognize where each others strengths lie, and thereby foster further development of projects which make a real difference in the learning environment of the university.

THE ELECTRONIC RESERVE INITIATIVE AT NORTHWESTERN UNIVERSITY

The main purpose of Northwestern University's Electronic Reserve System (ERS) is to support instruction in the University by providing course-support materials via the campus network. The project was initiated in early 1994 by librarians who were interested in developing a new service for delivery over the campus network while exploring the technical and policy issues involved in digitizing text, and by academic computing staff concerned with extending and refining communication systems already in wide use around the university. At the same time a task force was established with volunteers from several library departments to design and implement some system to offer electronic text, the academic computing organization was launching a number of instructional support initiatives including listservs, conferencing, and faculty Internet training. As the library was seeking avenues for development of new electronic services which had a clear library identity, academic computing was focused heavily on the wiring of all dormitory rooms and academic buildings, and sought to develop systems which would demonstrate to senior university administrators the validity of their own forward-thinking decision to invest heavily in network infrastructure at this time.

Along with these local forces leading both organizations to share in development of a new university resource, there has been a larger economic and legal pressure motivating the participants to implement the Electronic Reserve System in a timely fashion. That pressure is the issue of electronic copyright, specifically the strong interest the university has in preserving the principle of fair use in the new electronic environment. There is a lot of talk about copyright issues now, with the promulgation of the NII White Paper on Intellectual Property and the National Information Infrastructure,[2] the ARL statement on "Fair Use in the Electronic Age: Serving the Public Interest,"[3] and a draft electronic reserve guidelines document now under discussion within the research library community[4]. Northwestern recognized that it was important to reinforce the stated philosophical position that the fair use provision should remain operative in the new environment with a body of practice which concretely demonstrated that position. Saying that it SHOULD be acceptable by law to do something over which there may be disagreement is not the same as actually doing it. With our project, Northwestern has taken the position that the larger higher education community is not well-served by remaining in a state of paralysis on the electronic copyright issue. We have felt it important to show that a system can operate in a way respectful of publishers' financial interests yet firmly assert the fair use right that sets a limit on the protection of copyright holders.

ERS SYSTEM DESCRIPTION

The Electronic Reserve System began as a gopher-based document delivery system using the Gopher Plus Internet protocol. At the beginning of the 1995 academic year, the system migrated to a World Wide Web interface. Users must have a copy of a forms-capable Web browsing client (Netscape is the supported Web browser at Northwestern) and a connection to NUNet, Northwestern's campus network backbone, either through a direct Ethernet or a remote modem connection. The Electronic Reserve System at Northwestern may be accessed by any student, faculty, or staff member from all networked computers in the libraries, campus computer labs, dormitory rooms, and other campus buildings. Because access to ERS is restricted to the Northwestern University community, those users connecting via a modem from their homes or anywhere else off-campus must attach directly to Northwestern's modem pool through a SLIP connection.

The ERS Web site and documents are housed on the Library's Web server, an E-series Hewlett Packard UNIX server running Netscape Commerce server software. Its design structurally mirrors the gopher prototype used in the 1994-95 academic year, which was run on an HP 715-33 workstation. Users are offered two modes of access to the reserve materials, a "browse" mode and a "search" mode. The browse mode offers the user an ability to traverse a hierarchical tree of university schools, departments, and courses to locate material for a particular course, provided in a list. The search mode enables the user to locate ERS documents through searching by professor, department, or course name, either as single words or as multiple words combined through implicit or explicit boolean operators. The index, developed originally using Jughead in its first life as a gopher, is now built by SWISH, (Simple Web Indexing System for Humans), a free software product developed at CNIDR. Users are not permitted to locate any item through an author or title search, a design element deliberately made in consideration of copyright issues, issues to which we will return later.

Most of the documents distributed through the Electronic Reserve System are in Adobe Acrobat Portable Document Format (PDF). During the spring and summer of 1994, academic computing tested a number of electronic publishing tools, including Common Ground and Replica, before settling on the Acrobat family of products. Adobe's decision in 1994 to distribute the Acrobat Reader at no charge solidified this decision; the Reader may be downloaded directly from the Electronic Reserve home page or the NUInfo Campus Wide Information System and used as Netscape's helper application to view Electronic Reserve documents as well as many other documents published electronically for general campus use. Users may both view and print documents with the Acrobat Reader. Acrobat PDF files also support internal hypertext links and, with the latest release of the Reader, external hypertext links to locations on the World Wide Web and embedded Quicktime movies.

Acrobat PDF is based on the Postscript page definition language and can incorporate both text and bitmapped images. Documents in PDF appear onscreen in their electronic format much as they would on paper. The commercial products used to create these files are Acrobat Distiller, which will convert any Postscript text or graphics document directly to PDF, and Acrobat Exchange with its included PDF Writer. The PDF Writer acts as a printer driver with which the operator may literally print to a Portable Document Format file from any application. Exchange is used to collate and edit existing PDF files, to attach security specifications to individual documents, and to provide value-added document navigation features. We have also begun working with Acrobat Capture, a product which melds optical-character recognition functionalities with the other Acrobat products in use at Northwestern for nearly two years.

Documents are prepared by library staff in a number of ways. Documents which already exist in electronic format are the easiest to handle, and are welcomely received from faculty members; they are simply "printed" to PDF from the originating application with the Acrobat PDF Writer. To encourage use of this format, academic computing has also "seeded" Acrobat Exchange into a number of academic departments, enabling faculty to produce PDF files by themselves for use in classroom conferencing applications supported by the computing organization. This method is most commonly used with examinations, course syllabi, handouts and lecture notes. The faculty members can simply email as attachments such PDF files to the reserve staff who then make links to these files on the server.

Documents provided by faculty in paper format, such as journal articles and book chapters, are scanned. They may be converted to PDF as bitmapped image files, or are sometimes scanned and converted to text and then to PDF using an Optical Character Recognition (OCR) application. The decision whether or not to use an OCR package has been mostly based on the length of documents. Pages composed of bitmapped pictures of text characters are, without exception, a great deal larger in file size than those which contain recognizable text, but the time involved in using an OCR application, and its often mixed recognition results, has often made it an impractical choice for producing and distributing course materials. PDFs built from bitmaps are also slow to deliver over the network, and are essentially unprintable, though on-screen reading is possible and acceptable, if not always accepted.

We expect our recent purchase of Acrobat Capture to make documents existing initially only on paper to be much more amenable to network distribution, and thus to lead to much more scanning work. Capture's page-to-PDF handling of documents and its ability to retain both text and graphics in their original page layout, along with providing a very useful interface for human operator interpretation of OCR uncertainties, will also signficantly improve the slow printing problems our students now face.

The library owns three workstations dedicated to the production of Electronic Reserve materials, two Power Macintoshes and one Pentium PC. Each is equipped with a color desktop scanner, scanning software, the complete Adobe Acrobat suite (Distiller, Exchange, PDF Writer and Reader) and is attached to the network. Acrobat Capture is only installed on the PC as a version does not yet exist for the Macintosh. Common office applications which faculty may be using for authoring their original documents, such as Microsoft Word, WordPerfect, PowerPoint, and the like, are also on hand so that conversion through PDF Writer of such documents is possible. Three additional Wintel-based production workstations are planned for other library departments participating in Electronic Reserve.

Besides ERS availability being provided in all academic computing labs in the university, library-managed public workstations are in place in the Reserve Room on the Evanston campus and in the Schaffner library on Northwestern's Chicago campus. The public Macintosh and PC in Reserve are both equipped with DeskJet printers; the public PC's in Schaffner are connected to a laser printer. Three additional public workstations will soon be installed in the Transportation, Music and Science and Engineering libraries. Beyond the libraries, the Acrobat Reader software is installed on all machines in all the University's academic computing public labs. All printing in all locations — currently over 100 workstations in public labs and reading rooms — is at this time free.

For the first year of the Electronic Reserve project, materials were produced by staff in the Reserve Room of the Main library and staff working in the Schaffner. In August, 1995, a half-time professional position was added in Main Reserve; ERS demands the equivalent of one full paraprofessional position and one student work/study position from this department. The Schaffner staff member processing materials for ERS was able to incorporate his new responsibilities into his existing workflow. The Electronic Reserve task force continues to act in a planning, advisory and technical support capacity and currently consists of representatives from the music, transportation, science and engineering, preservation, and media departments of the library, as well as academic computing. The newest members of the task force have been additional participants from academic computing who have joined to lead the development of an Oracle-based database management system at the back-end, to tackle the automation of ERS administrative tasks.

SYSTEM EVALUATION

User evaluation of the Electronic Reserve System has so far not been analyzed in particularly formal ways, though comment from staff, faculty, and students have from the beginning contributed to design modifications to the system. Transaction logs of both the gopher and web iterations of the systems exist, though we've not exploited them for evaluation purposes as yet. Feedback from academic computing lab managers reveal that the use of ERS appears to be one of the most popular applications in all our labs, leading to additional growth in lab use and demand for printing. Student feedback is encouraged both via an electronic form on the web site and a paper questionnaire left at the library public dedicated ERS workstations. Student responses have in general been quite favorable, though problems with slow document printing are a source of significant frustration. Our expectation that students would read PDF files on-screen has proven to be naive; just as students often retrieve paper reserve materials simply to photocopy them, they retrieve the electronic files with the idea of printing them to paper. Printing delays are interminable with scanned/bitmapped PDF's, and often only tolerable with PDF files created from electronic originals, especially those with non-textual elements. Thus the nature of the materials placed on electronic reserve colors significantly the students' overall evaluation of the system.

Apart from some users' frustration with printing ERS files, other problems encountered have centered around users becoming more comfortable with the electronic interface. Requiring off-site users to acquire, install, and configure the Acrobat Reader software has caused some frustration, especially among users with older equipment and those who are unfamiliar with the functioning of their operating systems. We hope this particular difficulty will be reduced with the next releases of the Netscape browser and Acrobat Reader, which will allow users to view and print PDF documents from within the Netscape browser itself. We have also encountered students whose Internet access has been through external providers, such as Compuserve or Prodigy, and who thus are blocked from retrieving electronic reserve documents because their IP addresses do not reflect their Northwestern affiliation. Pointing out to them that they can overcome this problem by obtaining a free account and software from academic computing is of course appreciated.

Faculty have expressed interest in the system, but have been somewhat slow to respond. The most enthusiastic responses so far have been concentrated, with a few exceptions, in the graduate school of management and among faculty teaching in the sciences and engineering. Currently, twenty-one courses are supported on ERS in this Fall 1995 Quarter. A number of the faculty participating in the ERS project have been initially identified through their enquiries directed at academic computing staff in the areas of classroom conferencing, the use of electronic mail as a teaching tool, and their interest in linking self-produced web resources into the existing Campus Wide Information System infrastructure.

The migration to a World Wide Web interface has added more flexibility to the types of materials which may be distributed via the Electronic Reserve System. Rather than limiting course information to materials processed by library staff and stored locally on the library's web server, as had been the original model for Electronic Reserve, ERS pages now include links to other Internet sites. These sites include professors' personal or departmental gopher and web resources, newsgroups created specifically for university courses, and other Internet sites of interest. It is hoped that the Electronic Reserve System will no longer be seen merely as an electronic version of traditional reserve, but rather as a central gateway to student's course materials located at various electronic sites on campus and around the world. This approach to ERS offers faculty greater control of the organization of materials they place "on reserve," reinforces the library's gathering role by eliminating the need for faculty to communicate to students what are often long and complex URL's, and offers the institution a more unified approach toward dealing with copyright permission issues which will become increasingly contentious in the new electronic environment.

INTER-ORGANIZATIONAL COOPERATION

Both library and computing organizations made critical contributions to the development of this successful system. Librarians came to the project with a long experience in providing course support materials through traditional reserve functions and in developing successful information retrieval systems. This experience included considerable knowledge about copyright issues. They also brought a strong mission to serve all faculty and students — not just those interested in technology. The University Librarian was also willing to commit financial and staff resources to the project. The academic computing organization supplied a higher level of technical expertise than was available in the library as well as access to software and hardware resources in the development phase. It also provided a more current perspective of the development of the larger campus network. Academic computing made critical connections with Adobe, with faculty interested in participating in the pilot project, and with its own staff who would be responsible for implementing the system in computing labs. Finally, the academic computing representative approached the project with an experimental method new to many of the librarians, allowing the project to assume risks and move forward more quickly than one sees with most library projects.

The collaboration between academic computing and the library resulted in a more successful service than either organization could have developed independently.

A remarkable feature of the electronic reserve system in the eyes of many was that it was developed, tested, and implemented very quickly for a system of its size and complexity. Planning and design work was begun in the summer of 1994, a pilot was launched in the fall of 1994 in which over a dozen classes participated, and a production system was in place by the fall of 1995. During that time, the user interface was also rewritten and transported from gopher to the worldwide web. This rapid progress would have been highly unlikely in a project developed solely by the library with its more deliberative development style. The academic computing organization possessed greater technical expertise particularly in the areas of software selection and programming, as well as easier access to machine resources during the pilot phase. Although the initial server was a machine owned by a library department, it was managed by the academic computing organization. In addition, the academic computing organization was accustomed to developing projects quickly and delivering them to users without elaborate testing or extended internal review. The library task force elected to share in this development style, which allowed the project to move along quickly without much reporting to regular library review groups. As stated above, the motivation to bring forward a body of practice in the area of electronic copyright fair use proved a valuable spur to action across both organizations.

The interest in a speedy implementation led to a number of decisions being made that would have been much slower to implement had each organization felt they were working alone, clearly a synergy effect. The library implemented public Internet-accessible workstations in its reserve rooms so that user behavior could be observed and the system modified accordingly. At the same time the academic computing organization offered the service in its public computing labs, a practice that had not been so automatic in previous library projects. The representative from academic computing was able to work closely with the lab coordinators to insure that properly installed software was available and to address implementation problems as they occurred, rather than awaiting a hierarchical organization-to-organization communication process. This widespread implementation allowed many more students to access and experiment with the system than if access had been limited to a few public workstations in the library. Electronic reserve quickly became one of the most frequently used services in the public computing labs. Academic computing was also able to introduce the system as part of a suite of network applications that students were introduced to, rather than identifying it as a specialized library project. The computing staff approached the new system as just one of many that they had to implement and felt some ownership of the system. The sense of shared ownership, rather than a working relationship in which the computing organization merely offered technical advice on a system developed outside by the library, was critical to the project's success.

INTER-ORGANIZATIONAL CONFLICT

One should not regard the success of the Electronic Reserve System as a simple matter of interorganizational efficiency, as there were areas of conflict too. Recognizing that such conflicts are bound to exist can go a long way toward resolving them without their becoming insurmountable barriers which could otherwise cause similar projects to stall. We present here some examples, to demonstrate that teamwork often entails compromise.

One early difficulty encountered by the project occurred during the year-long pilot phase, when the delivery mechanism for reserve documents was gopher-based. Although Northwestern's computing organization had not at that time settled on which graphical user interface Web clients would be supported campus-wide, we had settled on gopher clients, as our rapidly-developing NUInfo CWIS was at the time gopher-based. The clients supported on the dominant platforms were TurboGopher and WSGopher, and Internet program disk suites were already being widely distributed among students and faculty interested in net connections. The library, on the other hand, had instituted their own process for deciding what software would be on library microcomputers, and had chosen the Boston College gopher as the preferred gopher client because of its uncluttered design. Though in most circumstances this library decision would not have significant impact beyond its own walls, the fact that the Boston College gopher did not support the gopher plus protocol, necessary for easy integration of Acrobat documents with the ERS user interface, the library was forced to revisit the decision as a result of the ERS project. Faced with the problem of weighing additional decision criteria that had not been recognized before, the library did reverse itself and supported the WSGopher as a standard, but the loss of autonomy in this case was for a while a sore point.

On the other side of the inter-organizational process, academic computing at first did not support the library's strong interest in delivering electronically-scanned documents through the ERS. Computing staff advocated restricting the service to documents which were natively available in electronic form, so that the corresponding Acrobat PDF files would not be extremely large and the copyright issues would be non-problematic. From the library's perspective, this restriction was absolutely untenable. Library staff argued that, even if printing and network delivery times were to suffer, a system calling itself a library reserve service *had* to accomodate paper documents if it was to maintain credibilty in the eyes of the faculty. Even though it is recognized that the decision has some service efficiency costs, both organizations now recognize the value the decision has had, especially in the area of setting prescedent in fair use of copyrighted material.

Still another area in which conflict has arisen, in this case within both organizations internally, has been the question of the viability of the Adobe PDF format as a reliable technology for sustained service delivery. Soon after the introduction of the Acrobat technology, there was widespread outcry from the SGML community that a format-description language such as PDF invited rapid document obsolescence, and this consideration led many in the library community to look upon Acrobat suspiciously. From open-system oriented technologists, there was similar concern about PDF. Why not just put up all the information in HTML, it was asked. This view has often been articulated despite the fact that the PDF specification is published, likely we suppose because of Adobe's status as a for-profit corporation. Both sources of objection to the Acrobat format have been quieted by the passage of time and the growing popularity of the technology, and it is recognized that the current difficulties with HTML authoring, the far distance HTML is from SGML in terms of capturing semantic meaning, and the quite transient nature of most reserve documents all confirm that the ERS decision to go with Acrobat has been wise.

CONCLUSION

Not only was its implementation smoother and faster, but the Electronic Reserve System has reached a broader audience of users than a service developed by either library or computing organization would have. Academic computing organizations tend to develop services for users who are interested and motivated to use technology. Libraries, the other hand, have always had broader mission to serve all user groups on campus regardless of their interest in technology. Because of academic computing's involvement, technology leaders among the faculty were recruited for the pilot project. Because of the library's involvement, the system was designed and promoted as service for all students regardless of their level of technical expertise and interest.

While the library could probably have developed an electronic reserve system on its own, it is doubtful that it would have been as innovative as Northwestern's electronic reserve system without collaboration with academic computing. The academic computing representative had already established a relationship with Adobe that led us to choose Acrobat Reader as a delivery mode before it was commonly in use. As we developed the system's gopher version, we had good support from the developers of WSGopher and the Minnesota gopher team. As ERS has been transported to the Web, we have been able to coordinate web development with other new projects in both academic computing and the library.

This collaboration resulted not only in an effective and successful electronic reserve system, but it also built and strengthened the relationship between the academic computing organization and the library. The differences in organizational culture between the two groups have been much discussed. As we worked towards a common goal, all team members developed new understanding and became more respectful of the human and political elements in both organizations. We developed a methodology which moved ahead quickly, but which included enough reporting and review to satisfy the library. We avoided many turf issues and minimized conflicts which often arise when organizations develop projects separately but implement them together. We established relationships which can and will carry over into other projects and initiatives as we build and enhance information technology across the university.

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[1] Anthony Downs, Inside Bureaucracy. Boston: Little, Brown, 1967.

[2] http://www.uspto.gov/web/ipnii/

[3] http://arl.cni.org/scomm/copyright/uses.html.

[4] "Fair Use Guidelines for Electronic Reserve Systems," available within the listserv archive of July 1995 for the arl-ereserve list, at listproc@cni.org.

IT SERVICE FOR ACADEMIC UNITS: THREE PERSPECTIVES

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Three institutions vary greatly in the manner in which academic departments receive IT services. A central computer services unit provides the IT infrastructure at Messiah College, a small private Liberal Arts college, and works with the academic departments in budgeting and prioritization of projects. The School of Education at Cal State Los Angeles, a medium-large, urban, public, comprehensive university, has IT infrastructure and certain services provided by the central administration with one FTE IT technician to augment services. The Department of Chemistry & Biochemistry, at UCLA, a large urban public research university, provides much of its own IT infrastructure and services. Services and strategies are described, differences examined, and critical success factors are highlighted.

IT SERVICE FOR ACADEMIC UNITS: THREE PERSPECTIVES

MESSIAH COLLEGE

Introduction and Background

Messiah College is a college of the liberal and applied arts and sciences located ten miles southwest of Harrisburg, Pennsylvania. It is a four year undergraduate institution with most of its 2,400 students living on campus. A wide variety of off-campus opportunities do exist, however, including a semester or year of study at Temple University.

Information technology resources have always been centralized for both academic and administrative computing. Like many other small colleges, IT services grew out of the Mathematical Sciences Department which at Messiah includes a computer science major. Early work in academic computing was primarily focused on meeting the needs of computer science majors; later it incorporated the Business and Engineering Departments, and then the rest of the campus.

Services Provided

For a small residential college, Messiah provides an environment rich in technological resources. The campus network backbone incorporates all academic and administrative buildings, the Learning Resources Center, and dormitories. Ethernet and Novell software are utilized in the system. In total, 10 computing labs provide easy access to over 200 microcomputers most of which have 386 or 486 processors. Many students bring their own computers and are able to access the network from their dorm rooms. For students who need more computing power, Pentium 120 MHz systems as well as SUN SPARCstation 20 machines are available in a special lab. In addition to computers in common labs, the IT staff supports many classrooms with 486 machines connected to local area networks and the campus backbone which are used with LCD panels in instruction. A faculty resource room also provides a place where new technology may be tried out by faculty and staff.

Software resources have grown tremendously in recent years as more faculty incorporate the use of technology in their teaching. Access to software through the networks comes through a common interface menu which is present at network login. Menu choices are given based on the level of access provided to the individual account as well as the lab from which the login was made. Because of excessive use of email and word processing from labs which includes our most powerful machines, access to some programs has been limited. Common software provided to most labs includes email (Pinemail for Students, HP Desk for faculty and staff), word processing, spreadsheet and database applications. Other programs for specific majors includes AutoCAD for Engineering, Lumena for Art, and Derive for Math. Faculty are also making more use of software which may come as part of adoption of a text for a course. Thus, Economics faculty may incorporate the use of an economic simulation, or a Sociology faculty member may use a database that is provided with the text in a research course.

Another major use of technology for the College has become the use of the Internet, and specifically browsing tools on the World Wide Web. Like many colleges, the first use of WWW was what has become commonly known as "surfing" where activity was not necessarily connected to a teaching or research agenda. While this type of activity still takes place and is seen to have value, several professors are using the Web as another way to gather data or information that can be incorporated into an academic assignment. Thus, it has become common for students to use the Web to locate home pages which may lead them to information used in a research paper, communicate with someone on a subject of interest, or use the Web in presenting a report to a class. For a campus far away from a large city or major university, the Web has become a vary valuable resource.

Because of the number and variety of academic resources, along with a limited IT staff, technical and developmental assistance has been limited. It has been the approach of the IT staff, supported by the administration, to limit the microcomputer purchases to a single vendor (which may change every few years), and to restrict the variety of commonly used software packages available through the network.

In this process they have adopted a layered approach to support of machines and software. Simply put, there are three layers of support: machines and software that are considered the standard for the campus, machines and software that may have limited use for a particular department, and machines and resources that are not considered as part of the campus standard and receive limited or no support from the IT staff. The level of support determines whether the resource is able to be connected to the network, whether training and user support is offered, and whether maintenance and upgrades are supported. At this time, these decisions are made by the IT staff.

Strategies

For the past ten years, the College administration and Trustees have given strong support to the development of IT resources on campus. This may well have come from their belief that such resources were vital to the College growing and providing quality education than calls from the faculty to increase resources. The direction for development of IT resources has continued to come from IT management who have stressed the development of hardware and network resources. One example of this was the recent construction of a 70,000 square foot academic building to house the Business, Mathematical Sciences and Engineering Departments. In the construction of this facility, a substantial investment was made to make the building ready to utilize technology whether it be in computer, science or engineering labs, classrooms, or faculty offices. In all the development of resources at the College, there has never been a charge-back system for the use of technology.

While the College is rich in IT resources their use in the instructional program has progressed slowly by the faculty at large. Like so many colleges of all sizes, the "first wave" of computer users wasted no time in seeing how the new technology could be used in the curriculum. At Messiah, this group included a few faculty mostly from the Math and Business Departments. The "second wave" introduced another dozen or so from a variety of disciplines who were mostly interested in how a particular software program might relate to a course that they taught. We are just now entering the "third wave" of users which could bring the total active user group of those who are seeking to incorporate some aspect of information technology into the classroom to a significant percentage of the total faculty.

Why has the number of active users among the faculty ranks been so slow to grow and make use of the substantial resources available on campus? Certainly many factors have contributed to this situation. Part is certainly attributed to the fact that the responsibility for developing IT resources came out of the Mathematical Sciences Department which was primarily interested in developing hardware and network resources. It is also partly due to the fact that there has never been a senior administrator responsible for IT as his or her primary focus. Another major factor is the limited input faculty have had in developing IT resources during the most substantial building years. These along with the absence of a strategic plan for academic computing has created an environment where there is strong hardware infrastructure from which to draw from, but where individual faculty must take the lead for the availability and use of software resources that they deem appropriate. In cases where their software is not available on the platform put in place by the IT staff, they are out of luck. For first and to some degree second wave users all this has been a manageable problem; yet, it represents a substantial problem for most others on the faculty.

Critical Success Factors

Former Times:

In their own way of thinking, the IT management and staff has always considered themselves to have had a "service orientation" to the users. Certainly their individual attention to faculty who came to them has allowed them to address specific needs of some faculty. Yet, the absence of an open and managed process for allocating resources has in the past made them appear more political than they perhaps deserved to be labeled. Service was seen as more a result of "making a deal" with IT management than as result of an open and fair process. The lack of any kind of evaluation instrument processed on a regular basis did not allow for user input as a group.

Prioritization of projects has been another weak area for IT management. Being run either through or with close collaboration with the Mathematical Sciences Department has made many faculty suspect. Certainly, evidence is clear that the best equipment has gone to the computer science labs. This perhaps is justified by the applications they are running in those labs; however, the fact that this is not decided as an open process has been a problem.

Another problem for IT staff has been that much of the current infrastructure has been developed during times when extra financial resources (e.g., with growth in the Freshman class) are available. Thus it has been difficult to build the infrastructure with a multi-year planned approach.

Finally, training and development has been difficult for IT staff as the number of students and faculty utilizing IT resources has grown while their staff has not.

Present Times:

In the past few years at the College, there has been a major shift in the management and delivery of IT resources to academic users. For the first time, the responsibility for IT has become independent of the Mathematical Sciences Department and has been placed with an individual who reports to the President. An active academic user committee is in the process of creating a strategic plan and will recommend prioritization of budget and IT projects on an ongoing basis. The governance document of the institution was changed so that the Associate Dean of the Faculty will, by position, chair this committee. This allows for focus on efforts to integrate IT into the curriculum. Budgeting is also being done on a multi-year basis where a special fund allows for maintenance and upgrades of hardware and software. Decisions have also been made to move to software packages for applications like email that will not necessitate training sessions. These are some of the factors that are contributing toward a successful approach for addressing user needs.

Conclusions

In some ways, one could argue that the College has failed to address the needs of many of its faculty and students in the past by focusing too much on the interests of a few faculty and spending too much time and resources on hardware purchases and network development. Yet, there have been benefits of a highly centralized approach in creating the campus infrastructure. The campus backbone, local area networks, labs, classrooms, and many other IT environments now provide a stable environment on which faculty and students may build.

The key critical success factors for the future will depend to what degree leadership and management for building on those resources comes from the broad group of academic users on campus, and to what degree senior management sees IT as a vital part of the College program. Should the focus shift from infrastructure to applications that address curriculum and research interests, then this small college will be able to offer something quite valuable to its students. If support is not there for this shift, either by senior administration or IT management, then IT resources will be underutilized and ineffective in addressing faculty and student needs, and substantial financial resources will have been wasted.

CALIFORNIA STATE UNIVERSITY, LOS ANGELES - SCHOOL OF EDUCATION

Introduction and Background

Cal State LA is a public, comprehensive, urban campus with just under 19,000 student headcount. The Graduate School of Education, one of six schools, has about 2,300 students. The Information Resources Management (IRM) division headed by a vice presidential level CIO has policy responsibility for all information technology projects in the university and provides the basic IT infrastructure for the campus. The office of Academic Technology Support (ATS), one of the IRM units, provides campus wide services to academic departments and has 34 full-time positions, six of which are located in various schools across the campus. Administrative computing is provided on an IBM ES9000, academic computing is supported by a network of Sun servers, a dedicated Unix based library system, a multi-processing Sun server with over 1,500 research databases, and a minisuper computer. All full-time faculty in the university have a networked computer on the desktop with access to both academic and administrative applications.

Services Provided

The Instructional Technology Support group contains 11 positions and provides administrative office, workstation maintenance, user, and technical support services. The Network Information Services group contains 9 positions and supports the Instructional Technology Center, small systems, and database administration. Four of the school based positions, including the one in the School of Education, are in the small systems area. The Network Operations group has 10 positions and provides systems development and network/distributed systems services. There are approximately 60 student assistants and half a dozen graduate assistants in the organization. The campus backbone is a FDDI network. There are 37 academic computing (three in the School of Education) and 10 experimental laboratories containing over 1,100 microcomputers across the campus, All of the student machines are 486 class or better; about 15 percent are Macintoshes. There are approximately 40 Sun workstations in the mix. An additional 600 faculty desktop machines are supported. About two-thirds of them are 486 or better class machines and the remainder are 386 class (again about 15 percent are Macintoshes). The laboratories are supported by distributed Sun servers and over 100 software packages are provided. All of the student machines have Netscape, access to a wide variety of CD-ROM and other bibliographic databases, the automated library system, and access to various network servers. There is a 72 port modem pool to support dial-in access. And an agreement with an Internet service provider for 60 hours per month at a nominal rate is available to all students.

Strategies

The centralized ATS staff provide overall planning and coordination for services and the network, negotiate site license agreements, maintain the servers, desktop machines and supported software, provide documentation and training, run the large general purpose laboratories, provide a server based email system, bulletin board, WWW, etc. (in general, support the basic infrastructure). The school based specialists provide direct support to the faculty, maintain local area networks, support software peculiar to a given laboratory, and assist in setting up the labs for special classes. CSLA has a policy of no charge back for academic services.

The IRM division was established in the mid-1980s and over a six year period installed the campus-wide network, expanded from about a dozen labs to almost 40, grew ATS from less than ten FTE positions to over 30, moved from a mainframe for academic support to the distributed client/server model, installed a new RDBMS based administrative system, and developed a strategic planning process for campus-wide IT. In the early 1990s, the California State University System experienced major funding cutbacks resulting in approximately a 30 per cent reduction in the IRM operating budget. Every effort was made to keep the academic support intact in ATS but some cuts were made and continued growth to keep up with the campus-wide expansion of information technology could not be maintained. Between spring 1994 and fall 1995, IT lab utilization increased by over 400 percent, library sessions increased from about 1,000 to 2,000 per day, in spring 1995 alone there was a net addition of 125 workstations on the network with no additional resources for ATS. Also in this time-frame, due to changes in administrative positions, ATS planning and coordination activities moved from working closely with Academic Affairs and the academic deans to working almost exclusively with the academic deans.

A fall 1995 faculty survey conducted by the Academic Senate showed that from 101 respondents, approximately 60 percent were somewhat or very satisfied with the Scholars Work Environment[1] (the common interface on all networked machines which provides access to the various resources) versus about 31 percent who were somewhat or very dissatisfied. A question regarding Scholars Mail (the server based email system) showed about 46 per cent of on-campus users somewhat or very satisfied versus 42 percent somewhat or very dissatisfied (n=112). The same question from 85 off-campus users showed about 24 percent somewhat or very satisfied versus 53 percent somewhat or very dissatisfied. Some 55 percent of on-campus Macintosh users were unhappy with Scholars Mail and 59 percent of off-campus Macintosh users were dissatisfied to some degree. Of 104 on-campus respondents, 60 percent indicated occasional or frequent problems encountered in the last quarter. And of 80 off-campus users, 62.5 percent reflected some level of problem occurrence in the last quarter.

Critical Success Factors

During the initial years of IRM as the network grew, additional resources were able to be allocated to support the growth. Also, during this period of time, significant efforts were employed to persuade faculty to increase the use of information technology in the classroom. When the budget crisis hit, despite the fact that ATS was cut less than any other part of IRM, it could not keep up with the continued need for more and more services (even though resources were reduced, the growth curve having been built for several years did not level off). Indeed, it is feasible that the budget cuts may have accelerated the use of technology by faculty and students as new and sometimes dramatic resources became available on the Internet.

The early success of SWE led to the development of a client/server based email system designed to be integrated into SWE. For a variety of reasons, it did not provide the same level of service as other email systems with which it was compared--this was especially so for off-campus and Macintosh users.

Conclusions

The IRM division and the ATS unit developed a faculty and student oriented posture over a several year period. That led to the establishment of an expectation level that could not be fully maintained when state resources were significantly reduced. The situation is made even more difficult since the growth in faculty and student usage has continued to increase while ATS resources have remained level at best. .

UCLA DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY

Introduction and Background

The UCLA Department of Chemistry and Biochemistry, ranking ninth in the nation, is comprised of 47 faculty, 15 emeriti (with 10 in residence), 61+ FTE administrative/departmental support staff (83 headcount), 71 research staff, 69 post graduate students, 1,188 graduate students, 2,659 undergraduate majors and 150 TA appointments. Annually, the Department provides lectures for up to 10,000 students from the campus and holds instructional chemistry labs for 7,000. This $31M operation is funded through state funds, university funds, various gifts and donations and annual contract and grant research funding of over $11M. Of the $31M, $2.5M can be considered "operating funds" for the ongoing support of departmental staff and support salaries, administration, and instruction.

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[1] Donald Carder and James Penrod, "Providing Access for The Scholars Work Environment (SWE)," *Proceedings of the 1994 CAUSE National Conference*, (Boulder, CO: CAUSE, Nov. 30-Dec. 2, 1994), III-5-1.

Organizationally, the Department is managed by the Chair, Vice Chair, Executive Committee and Chief Administrative Officer (CAO). Comprising the support infrastructure of the Department are Offices of Personnel, Business, Mail and Information, Graduate and Undergraduate Offices, Chemical and Research Equipment Storerooms, Receiving, Machine Shop, Glass Shop, Micro Computing and Electronics Shop, Computer Services, Mass Spectroscopy Lab, NMR Lab, X-ray Lab, and support units for the various Instructional Labs.

Four years ago, the California state budget began to have a very negative impact on the departmental level budgets at UCLA. During the ensuing years, over $800K was cut from the operating funds of Chemistry and Biochemistry. A proactive and realistic departmental budget required a thorough review of all expenditures and management strategies. Each item was reviewed, sub-budgets for each of the various units was instigated for management by the personnel directly responsible for each unit. This process necessitated the layoff of many personnel; however, at the same time it was recognized we could not operate in a "computer vacuum" and new workstations and software, better LANs, and email packages were purchased or employed. Faculty were given one-time departmental allocations of $1500 each to buy additional computers or peripherals to accommodate for the loss in secretarial staff.

Services Provided

Central computing at UCLA is supported by the Office of Academic Computing (OAC) serving the research community and Administrative Information Services (AIS) charged with only central administrative system development--not departmental. Therefore, it is incumbent on the Department of Chemistry and Biochemistry to operate it's own IT infrastructure. The Department maintains a 180-node Ethernet computer network with two interfaces to a CISCO router, and an 18-node Token-Ring network. Internally the Ethernet network is further split into multiple bridged and brouted segments to minimize the traffic. TCP/IP, DECNET, AppleTalk, and IPX/SPX protocols are supported on the Ethernet network and only IPX/SPX on the TokenRing/Novell 3.11 network. The departmental networking is centered around four LANNET LET-36 Intelligent Hubs with multi-channel (4 Ethernet, 3 FDDI/TokenRing, and 2Gbps Hi-Speed) backplanes. The LET-36 Hubs containing segment-switchable 10-BaseT modules, Brouters, FOIRL modules and Terminal Servers are SNMP-compliant and are managed through MultiMan Network Management System. Networked computer equipment is manufactured by Apple, IBM, HP, SGI, Sun FPS (Cray) and other vendors. In addition to the standard TCP/IP applications, there is a Client-Server Electronic Mail system (Eudora 2.1.2), a departmental Gopher server, and a World-Wide Web service using Netscape. This infrastructure serves over 400 networked Apple Macintosh, IBM PC and compatibles, Unix workstations and servers, and VAX workstations distributed between faculty and staff offices, research labs, teaching labs, shops and service areas. By and large, the Department is considered to be a "Macintosh shop."

All members of the Department--students, staff and faculty--have access to email, WWW, Gopher and FTP servers. The WWW for Chemistry (accessed 1,000 times daily from around the world) includes complete descriptions of each faculty member's research, course listings, departmental calendars, and hundreds of other chemistry resources. The most common software and user interfaces used in the Department include: DOS/MS Windows, MacOS/Finder, Unix/X-Window System; Informix Databases, Netscape, Qualcomm Eudora, Access, MS Word, Excel, FilemakerPro, PowerPoint, and ChemDraw. Online scheduling packages such as Now-Up-To-Date are just being evaluated and tested.

Technical assistance is provided by two service units: (1) The *Microcomputer & Electronics Shop* (3 FTE) is responsible for PC and compatible machine set-ups and initial training, repair, maintenance and upgrades as well as laying cable for LANs and hookups to the LAN/backbone. Services are recharged by a labor hour rate plus materials: extramural user rate of $62/hour and subsidized departmental rates of $56/hour (urgent request) and $46/hour (standard requests). (2) *Computer Services* (2.5 FTE, led by a Ph.D. in Chemistry) provides ongoing consultation, documentation, connectivity, assistance with program crashes, etc. For these services, the faculty members are charged based on their "use" of computers. Most faculty are considered "small" users and charged $650/year while a very few computaional chemists pay $1250/year. For specific assistance on new projects, recharge rates are set at $115/hour for extramural users and the subsidized rate of $75/hour for internal departmental users.

It is important to note that the departmental administration budget is also charged the same rates as are the research contracts and grants for assistance with administrative and instructional computing.

Instructional Computing:

Several courses in the Department are oriented toward teaching students about computing in general and specifically about various applications of computers in Chemistry such as the complete computer-based series of "lectures" (ChemTV=AE) developed for the second year Organic Series. There are both advanced undergraduate and graduate level classes dealing exclusively with Computational Chemistry (Chemistry 125 and 245). The Department maintains the Chemical Calculations with Computers (C3) Laboratory with 26 microcomputers for use by undergraduate students taking any of the Chemistry courses. This laboratory offers software for Molecular Modeling, NMR Data Processing, Technical Document Preparation, etc. A suite of programs on the VAX/VMS cluster was developed to assist with Student Data Entry, Grading, and Enrollment in all lower division undergraduate laboratories.

Research Computing:

A number of research groups within the Department are actively involved in Computational Chemistry. These groups utilize both local computing resources as well as those proved by UCLA Office of Academic Computing (OAC) and NSF Supercomputing Centers. In addition to microcomputers, workstations, and superminis available to some groups, the Department's VAX cluster which consists of six VAX processors supports over 200 faculty and postdoctoral/graduate student users. Most users of the VAX cluster are involved in writing custom applications, accessing networked resources, and communication. Departmental computers control the operation of instrumentation in X-ray Diffraction and Mass Spectrometry Laboratories. Industry-standard RISC workstations are used for consoles for the recent generation of the NMR spectrometers allowing for remote data processing using the X-Window system.

Administrative Computing:

Through the campus backbone, the Department participates in the university supported online administrative systems of Personnel, Finance, Contract and Grant Management, Purchasing, ASAP (post audit transfer of funds), and Student Information Systems.

Internally, the Department has had for many years its own self-written recharge program to charge contracts and grants or faculty for the various departmental shops and sales services. Tapes from this system then are sent to the campus financial system for input. In the last four years, each and every administrative desk has received a Mac Centris or IIsi with Word, Excel, and Eudora as baseline functions. To some degree, this has allowed the Administrative Office internally to automate personnel action changes with the faculty by attaching files through Eudora email connections. This same capability will allow faculty to have monthly updates of grant financial reports. Excel has also given the Department the capability to develop a complete budget system (shadow) combining all operational funds and dispersing them to the various shops and offices for internal management.

Additional technical software assistance is provided by a single administrative staff member for the entire department. The programmer who serves as DSA for the Department to the Central Administrative Systems, also has ongoing responsibility for training Business and Personnel Office staff.

Service Strategies

Lacking specifically identified funding from outside the department for computerization, it is nonetheless the belief of the departmental management that Chemistry and Biochemistry can not maintain its national standing without the very best in computer support. The Department has been considered a leader on the campus in computing for well over a decade when the internal VAX based administrative/research systems were written and because of the early dedication to a user friendly Macintosh environment. Central university administrative systems (which prefer IBM PCs) have been requested and are finding ways to support Chemistry's Macintosh environment [however reluctantly] for the institutionally mandated online systems. As central systems improve over time and some reengineering takes place, there will be less need for the shadow systems currently in place. Internally, the WWW technology can be leveraged to make a greater variety of information related to administrative functions available to all faculty staff and students such as recharge rates and actual use of Chemistry shops and services by individual contracts and grants.

In addition to equipment and accessibility, the ease of computing is of paramount importance--therefore, it is critical to continually employ better software such as Eudora email, new user training materials and to make information more readily available through client-server technology.

Since the recent past has needed to focus on administrative development, it is now the departmental priority to upgrade instructional computing. The C3 Laboratory, for instance, has not been able to upgrade its computers for three years. Additionally better programming off the VAX system and onto the Informix will assist the grading and chemistry experiment results reporting currently in place in the instructional laboratories especially in the First Year Laboratory Courses. Upper Division students using Beckman DU 650 Spectrophotometers would be better served if these were on-line speeding up grading time and providing more time to repeat experiments that have not worked and to achieve quality data. Graphing programs such as Igor need to be programmed to facilitate instruction so that students will be better able to analyze the results of their data. Students have been given their own email accounts, yet, there is a need for continued expansion of this capability. Currently a new project in development called Virtual Office Hours (using WWW) is having a significant impact on the communication capability between faculty and students.

Serving the research effort will continue to be a major strategy focus. Improving services such as migrating research databases and applications off older less reliable and costly systems such as the VAX is needed. The Department must continue to be dedicated to supporting the academic endeavors described by one of our leading research chemist as simply "four things": (1) Number one is manuscript preparation using a variety of software, graphics, and computational programs; (2) Communication (which he says is beginning to push number one) in a world where collaborators may be in places such as Crete and Moscow which have "notoriously unreliable postal service" by having not only instantaneous email, but also exchanging the formatted manuscripts; (3) Teaching, possibly using extensive video animation, and communicating with the students via the recent development of the Virtual Office Hours project; and, (4) Research data acquisition. While this researcher and others like him are completely conversant with the software they are using, they feel absolutely dependent on the high quality of network connections and hardware support the Department provides.

Critical Success Factors and Conclusion

A proactive service orientation, maintenance of creative problem solving units, and strong backing for the computer support staff are absolutely critical to successful systems implementation. The Department can not afford to ignore the computing program and must do whatever is in its power financially to make the systems more available and more easily utilized by its clientele. Recent developmental work was essentially planned and carried out under the direction of the Chair, the CAO and the lead Programmer in consultation with various departmental units and faculty. While such initiatives as those enumerated above are good, there must be a sustained overview of policy and planning conducted by a departmental committee representing an integration of research, instruction and administrative computing interests. At the beginning of the major budget cuts to the Department, a Computer Committee was put in place to review systems from both the administrative and research perspectives; however, this committee enjoyed only about one and a half years of good use except for some ongoing review of recharges. It is suggested that this committee be reconvened on an ongoing basis with responsibility to strategize on future system implementations which are in the continued best interest of the Department.[2]

GENERAL SUMMARY AND CONCLUSIONS

Common Critical Success Factors

A service orientation: In sometimes very different ways all three organizations have emphasized a customer and service orientation. What is perceived as a service orientation depends very much on the culture and past expectation level of the campus.

Currency of the IT infrastructure: All the institutions have made significant on-going efforts to maintain an up-to-date IT infrastructure which enables faculty and students to have access to networked desktop machines, common software, the Internet, and other IT resources available through the campus or regional networks . It is absolutely clear that such an infrastructure is crucial for the utilization of IT in the classroom.

A prioritization process: Again in very different ways each unit has developed a prioritization process that reflects the culture of the place and allows the most needed services to be given the highest priorities. It is important that not only this occur but also that *perceived* priorities be taken into consideration and dealt with in the user community.

On-going education, training, and support for the individual: Each of the organizations has done this to varying degrees. There is a direct correlation between the level of support for activities of this type and the on-going level of satisfaction demonstrated by the user community.

Change management: As the infrastructure matures, the external environment exerts pressures, and the expectation level evolves, IT management must adjust and realign strategies to meet new and perceived needs if it is to receive good marks from faculty and students. Once more, it is as important to deal with perceptions as it is to react to reality.

Standardization: Each IT unit has initiated a set of standards which enhances ease of use, decreases maintenance efforts, lessons training, and enables the infrastructure to be more easily upgraded. This strategy is one not easily put into place in an academic environment but when established it seems to be valued by almost all.

A steady stream of on-going funding: This is inherent from all of the above. It is not a given in many IT environments. Often allocations are made for one specific thing without regard for other consequences, or cuts in one area are made without regard for the impact elsewhere. If the infrastructure is expanded but support services are not, the result will probably be a perception from the user community that support services have been reduced.

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[2] Gratitude is given to the following individuals from the UCLA Department of Chemistry and Biochemistry: Max Kopelevich, Programmer IV, for the explicit system descriptions herein and to Professors Christopher S. Foote and Kendall N. Houk and Academic Coordinators Marian Dietrich and John Mouser for evaluative remarks.

Conclusion

Goodman, Sproull and associates have said "...that technology is a socially constructed reality. This means that individuals or groups assign meaning to technology, which in turn provides direction for selecting information, retaining information, and making inferences about the relationship between technology and the environment. This socially constructed model is critical in understanding the use of a new technology, changes in processes or outcomes, and subsequent modification of the technology."[3] It is the belief of these authors that the validity of this statement is illustrated by the examples contained in this paper.

Certainly there are physical things that must be done if an institution is to have an IT infrastructure that is well regarded by its faculty and students. However, the physical infrastructure alone will not bring satisfaction to the users of it. Attention must be paid not only to the services offered on how to use the infrastructure but also to the organizational culture and climate in which the infrastructure is utilized. Too often those of us in IT management roles do not pay enough attention to the socially constructed reality of the technology we supply.

10/31/95 (JP)

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[3] Paul S. Goodman, Lee S. Sproull and Associates, Technology and Organizations (San Francisco: Jossey-Bass Publishers, 1990) p. 259.

TEAMING UP TO PROMOTE EFFECTIVE TEACHING, LEARNING, AND RESEARCH USING TECHNOLOGY

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ABSTRACT

Teaming Up to Promote Effective Teaching and Learning Using Technology

At the University of Delaware, four units came together to plan a joint summer institute to assist faculty with learning to use information technology. The four units collaborating on this special program, held June 1995, were User Services/Information Technologies, the Library, the Center for Teaching Effectiveness, and the Instructional Technology Center. Each unit has a significant history of offering faculty seminars and workshops which promote new aspects of teaching and learning. These four units worked together to plan and execute the program, which highlighted faculty presenters as well as how-to hands-on workshops taught by computing and library professional staff with guidance from the Center for Teaching Effectiveness. Not only has the University's computing network increased opportunities for faculty and researchers to work together—its presence has created new alliances among University groups who support faculty development in using information technology and resources.

TEAMING UP TO PROMOTE EFFECTIVE TEACHING, LEARNING, AND RESEARCH USING TECHNOLOGY

AUTHORS

Janet de Vry, Manager of Informational and Instructional Services, User Services, Information Technologies, oversees the instructional services and the creation of technology-related information for the University community. Judy Greene, the Director of the Center for Teaching Effectiveness, develops and facilitates workshops for faculty covering areas related to more effective teaching and learning. Sandra Millard, Assistant Director for Library Public Services, administers all services of the University Library provided by 70 staff in 12 service areas, including professional staff who provide user education and "electronic library workshops" offered on a regular basis. Pat Sine, Manager of the Instructional Technology Center housed in the College of Education, develops and teaches workshops for faculty to learn development of multimedia instructional materials.

INTRODUCTION

The tall trees and green lawns of the University of Delaware campus provide a garden-like environment for its 20,000 students and 1,000 faculty. As the winter of 1994 ended, the University had just received the CAUSE award for Excellence in Campus Networking. On the campus mall, the roots of the new electronic network beneath the campus were alive and moving data at speeds of 100 million characters per second, the learning environment was ripe for another kind of flowering, and buds prepared to blossom. The Library, 28 microcomputing sites, every classroom, and every Residence Hall room was wired for Internet access. State-of-the-art, technologically advanced lecture halls and classrooms were in place. The early harbingers of this new season were the innovative faculty at the forefront of designing new electronic instructional programs.

How does the University assist all faculty in applying the tools of technology to their garden—that is their classroom—where the real flowering may have the ability to transform education?

The University provided faculty with an innovative, week-long technology institute developed by a team from four University divisions. The process by which this week-long institute evolved and the design of instruction provides a successful model of creative collaboration for faculty and instructional development programs.

Four University divisions, which had not previously collaborated on large instructional projects, worked together successfully to provide a new type of program.

The beauty of what occurred was in its simplicity. That very simplicity makes this project one that can by duplicated by other Universities.

Surveys of colleges and universities across the U.S. report that most faculty are comfortable using computers for word processing, and some use electronic mail to communicate with their students.[1] But, the application of technology to teaching has been slow. For many faculty, technology in the classroom means that word-processed overheads have replaced handwritten overheads. What explains this phenomenon?

William Geoghegan from IBM uses the theories of Moore and Rogers to describe how to understand the different reactions that faculty might have to innovations such as new technologies. He identified adoption behavior along a continuum. Beginning with the innovators and early adopters, he described traditional faculty as the majority or mainstream faculty, and the nonadopters as the 15%s who will never adopt these technologies into their classrooms. He emphasized that the majority need assistance in crossing the chasm to technology adoption.[2]

At the University of Delaware a team representing four University divisions developed a highly successful faculty institute. This week-long faculty institute was designed and implemented within eight weeks. How did four divisions of the University come together as a team to work collaboratively on major faculty development project?

CATALYST FOR CHANGE

The wiring of the campus focused the attention of faculty and administrators who were already actively using electronic resources and technology. The challenge was to develop the interest and skills of all faculty and to encourage greater use of technology in teaching and research.

The Provost initiated a meeting chaired by the Vice Provost for Academic Affairs. The meeting included selected faculty and administrators who were directly involved with either faculty development or technology programming. The two purposes were to address the need for more technology-related educational programs for faculty and to encourage technology use in teaching.

The divisions represented included Information Technologies, the Library, the Instructional

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[1] "Information Technology Moves Slowly into the Classroom," The Technology, Teaching and Scholarship Project, University of Southern California, October, 1994.

[2] Geoghegan, W.H. "Whatever Happened to Instructional Technology? Reaching Mainstream Faculty." International Business Schools Computing Association, Norwalk, CT. July 1994.

Technology Center, and the Center for Teaching Effectiveness. The committee also included faculty who represented both novice and advanced users of technology. Two meetings of this group were held to discuss how best to provide to faculty assistance in using technology in the classroom.

The first outcome of that meeting was a survey of faculty needs designed and conducted by the Center for Teaching Effectiveness. Generally, the survey results served to dispel several myths about what faculty knew, wanted to learn, and pinpointed areas where the four divisions concentrated their efforts.

The second outcome of that meeting was that the administrators from the Library, Information Technologies, Instructional Technology, and the Center for Teaching Effectiveness then joined together in the decision to develop and implement a technology instructional program for faculty. Directors of each of the divisions then asked the appropriate individual in their area to meet and plan the project.

THE SURVEY

With input from the initial committee and the Center for Teaching Effectiveness (CTE) Faculty Advisory Boards, the CTE developed a survey, which was mailed to approximately 950 faculty; one third (315) returned their responses.

The survey responses told us much about faculty learning needs. A summary of those items which may be of general interest to this group includes:

- The majority of faculty respondents use their computers in both office and at home.
- The majority of respondents described themselves as intermediate or advanced users.
- The 1/6 who described themselves as novice or non-users may have given us the most valuable information.

Over half this group wanted to learn the following:

- how others are using technology in their teaching
- how to use a networked environment

Nearly 2/3 wanted to learn the following:

- to use the Internet to retrieve information
- to prepare text and graphics to send on the Internet
- to use video, CD, and audio
- to learn about electronic library resources

Approximately ½ wanted to learn the following:

- use e-mail creatively in instruction

- to communicate with and distribute materials to students
- to use computing applications to conduct research
- to design and conduct courses using TV and video

Although a few wanted basic instruction in software such as word processing and operating systems, one third wanted to learn presentation software and how to use the Ethernet and cable TV connections and capabilities in our classrooms.

Their preferred learning styles vary, and approximately half our respondents said that for their own learning, they prefer hands-on, step-by-step instruction in small groups with practice time and individual assistance. After taking a training class, they most often want individual consultation on a single item and 1/5 need consultation on how to apply what they learned to their own particular instructional projects. One-fourth wanted tip sheets and written reference materials.

When asked what they MOST need NOW in order to use technology in their teaching, responses were scattered, but 40% said they want intermediate and advanced applications to learn new features. Fully 1/3 need help using the skills they already have to design classroom applications, and how to get funding for software, equipment and development time. This is not surprising given the majority of respondents are intermediate or advanced users of technology. The novices asked for the basics on how to begin to use their computers, the ITV classrooms, video and/or satellite facilities, and basic instructional design skills.

Typical comments received were like the following:

"I need to see what others are doing, so I know what is possible and then have time to think about what, if anything, I might want to do."

"What's available and how do I use it?"

"What are my choices?"

"Where to go and who to contact to find out what is available and how to gain access to equipment, software, and classrooms."

Other comments and questions were very specific to particular individuals who asked how to get specific kinds of cable, software, equipment, funding, and so on. When asked whether the person completing the form would be willing to teach other faculty how to use technology, 38 faculty said, "yes", and gave us lists of things they would be willing to teach, ranging from how to use software such as WordPerfect and Windows all the way to multimedia applications.

TEAM PARTNERS IN TECHNOLOGY EDUCATION

Each of the four University divisions involved—Information Technologies, the Library, the Instructional Technology Center, and the Center for Teaching Effectiveness—has significant experience in providing instruction and training. Each division also has a commitment to enhancing education, but with a different focus.

Information Technologies has long been offering classes in computing applications such as word processing, spreadsheets, and statistical programs, and it has been moving aggressively into teaching University faculty, staff, and students to use Internet resources and presentation software.

The Library has always provided instruction for finding information in all forms. This instruction includes classroom teaching, computer assisted instruction, and the electronic library sessions open to the entire University community. Workshops include those to help users find scholarly information on the Internet and the Web for research.

The two other team partners have a slightly different history. The Center for Teaching Effectiveness provides faculty development through instructional consultation. Services include help with how to design, conduct, and evaluate instruction as well as teaching faculty to use effective teaching strategies such as problem-based learning.

The Instructional Technology Center is a self-supporting unit in the College of Education, which relies on grant funding, and assists faculty in developing multimedia courseware, including offering workshops on creating multimedia.

PLANNING PROCESS

The formal planning process for the development of a unified program of instruction for faculty on using technology at the University was surprisingly brief. Much of the actual planning was carried on in the individual divisions. How was this possible? Early on, the division representatives developed a consensus on how to proceed and on what could reasonably be accomplished. The initial meeting of administrators and faculty provided the catalyst, but the implementation was completely the responsibility of the four team members.

Attendance at a symposium on teaching and technology at the University of Maryland gave the team additional ideas for planning. The two hour ride each way provided time for the team to brainstorm and share ideas, and make decisions about what would be best for the Delaware faculty. Each team member then had one or two meetings with appropriate staff in their division responsible for training. Communication among the team members was largely by e-mail. Only one formal planning meeting was held by the team after the trip to Maryland.

TEAM DECISIONS IN INSTRUCTIONAL FRAMEWORK

In one afternoon, the team members had designed the framework for dissemination of information to faculty and decided on an overall instructional design. An important decision that allowed the date to be set only eight weeks later, rather than many months later, was that the majority of workshops were to be those previously developed and successfully held. The consensus was that the majority of faculty had not attended all, or even most, of the workshops already available to them. The concentration of classes into a single week would enable faculty to immerse themselves in learning and, perhaps, make the leap across the "chasm." Even faculty who did not participate in the week long institute, would become more aware of available instruction and might take advantage of repeat presentations later in the semester. Each of the four units selected their own workshops to be offered after consultation with trainers and librarians in each area.

Specific decisions made involved:

Participants: The participants would be limited to University of Delaware faculty and graduate teaching assistants. This would encourage participation and allow sufficient resources and staff support for all interested faculty.

Time: The time was set as a one-week period from June 5-9, 1995, the first week of the summer session. This time was selected because statistics of previous years and the survey indicated that early summer and winter sessions are when faculty say they are most likely to attend workshops.

Content: The second decision was to offer several workshops which had been previously developed and presented in the past year. Workshops were between one to three hours long. Demonstrations of newly wired electronic classrooms would be included in an "open house" mode. These classroom open houses would include descriptions and presentations on how to use the various computing and multimedia equipment available in these large classrooms.

Location: The third decision was that most workshops were to be held in electronic classrooms. The Library, Information Technologies, and the Instructional Technology Center, each has its own instructional classrooms equipped with enough networked workstations to allow each faculty member hands on experience.

Faculty involvement: Faculty from the original Provost sponsored committee reviewed the team's plan and gave it strong endorsement. The fourth decision made was that although it was very desirable to offer a segment during the week that included faculty presenters, the time was limited to secure commitments of many faculty for this first Institute. Some well-known faculty presenters on-campus agreed to make brief presentations on how they used some of the same computing applications. Information Technologies then offered hands-on workshops the same week on compatible topics.

Advertising: The Center for Teaching Effectiveness took responsibility for compiling and organizing the schedule and producing a brochure, which included a detailed schedule of workshops, description of classes, registration form and procedures. Graphically, the brochure was a simple 11" X 17" yellow sheet folded in half, with 10 point type listing all workshops chronologically, followed by a brief description of the content of each.

Registration: Registration was decentralized to each of the four units. Each unit had already established registration procedures and staff and was responsible for handling phone, e-mail and paper registration of faculty signing up for workshops. Registration procedures instructed faculty to contact the presenting division to register, and those staff could then answer questions related to alternative times and the content of the workshop. This process utilized existing systems, staff, and procedures.

Fees: All workshops were at no cost to faculty. Each division assumed the cost of production of materials for its workshops. The Instructional Technology Center, the only one of the four divisions which charges for its multi-media instruction workshops, simply offered their empty seats during that time period to faculty at no charge.

WORKSHOPS AND TECHNOLOGY SESSIONS SCHEDULED

Most workshops selected had already been developed, presented, and favorably evaluated. Some new workshops were developed in response to the needs expressed in the faculty survey. The week long Institute was divided into 33 time slots, based on the length of time required by the presenter, most from one to three hours in length. Information Technologies, with assistance from the Center for Teaching Effectiveness, arranged for three general sessions. These were designed to provide an overview and to include faculty presenters. These included:

"Enhancing the Traditional Classroom with Electronic Communication" in which three faculty members described how they had used e-mail, newsgroups, and the World Wide Web with their students.

"Choosing the Right Tool for Your Class" was a panel of the same faculty discussing the relative advantages and disadvantages of the various tools for particular tasks.

"Using the Classroom of the Future NOW" in which faculty and Information Technologies staff presented brief modules on different classroom applications of technology.

Workshops offered during the remainder of the week focused on those features which faculty could apply to teaching and included:

Information Technologies workshops:
"Getting Started with Pine Mail"
"Getting Started with PowerPoint"
"Using Newsgroups to Extend Classroom Discussion"

"Using E-mail to Extend Classroom Discussion"
"Building a Home Page for your Classroom on the World Wide Web"
"Teaching with Video and Instructional Television"
"Using PowerPoint for Video and Television Instruction"

Library workshops:
"Electronic Access to Journal Information"
"The Web as a Library Resource"
"Current Contents on DELPLUS"
"Electronic Document Delivery using OCLC FirstSearch and CARL UnCover"
"Scholarly Resources on the Internet"
"Government Resources on the Internet"

Instructional Technology Center workshops:
"Creating Multimedia Objects"
"Using PODIUM"
"Multimedia Toolbook"
"Managing Multimedia Development Support"
"Managing Multimedia Delivery"

EVALUATION AND FEEDBACK

Workshop Evaluation and Feedback

Evaluation of the first Institute indicates that faculty expressed overwhelming satisfaction with what they learned (98%). Faculty who attended are excited about what they have been doing this fall semester to use e-mail or newsgroups to extend class discussions, or having students retrieve syllabi and assignments via the World Wide Web, for example.

The Next Step

The next University of Delaware Faculty Institute will be held in January, 1996, and will be called the "Teaching, Learning and Technology, Winter Institute for Faculty and TAs." Some sessions offered last June which were duplicated have been deleted. A call for proposals for the faculty demonstrations was added, there will be two faculty from the University of Maryland providing keynote sessions, and the popular hands-on workshops will be repeated.

For future planning, there are a number of issues to be kept in mind. One of them is the human factor. Although most faculty are accustomed to being seen as experts, when they are novice learners, they experience the same anxiety that any new learner experiences.

For example, one of our faculty members commented that before the workshops, the idea of using technology seemed overwhelming. After the workshops, the main change he reported was: "... the information was available on how to do what I needed and I had an idea of the possibilities. The other significant part was the support I received all along the way from Information Technologies. The support was the most important part." Those who remain sensitive to these factors, while at the same time helping faculty come to grips with being a student again (learning to say "I don't know"), and helping faculty save face in the process, may be more successful in helping faculty to adopt new technologies.

Through the survey, 38 faculty indicated they would be willing to teach other faculty how to use technology, our goal is to create teams of faculty and technical consultants who will co-lead these training sessions. As our faculty become more knowledgeable with these new teaching tools, it is expected there will be more expertise available to offer additional workshops which are focused primarily on the teaching and learning applications instead of learning how to use software.

A variety of options will need to be available to accommodate the various ways faculty learn new skills. Workshops alone will not provide for the full range of learning needs. Already sets of self-paced multimedia development materials (text, CD-ROM, and videotapes) and other self-paced instructional video tapes are available in several locations around campus for faculty to borrow. A Multimedia Users Group (MUG) meets monthly to share their expertise with each other. A number of novices have joined the group to learn more. The feasibility of setting up additional development labs with accompanying teams of instructional and technical consultants to assist faculty in developing educational materials is being explored. The units which planned the Institute will soon meet with other units, such as the Registrar, to determine how best to provide comprehensive "classroom services" for faculty questions related to classrooms and teaching. Because our administration is committed to keep teaching and learning at the center of our technology usage, some believe that the CTE is the appropriate first point of contact. And, since evaluation has always been and continues to be a key to any model employed, continued evaluation and feedback will be used to gather faculty and student data on the services which are initiated.

As useful and important as the pedagogical functions of technology may be, it becomes apparent very quickly that its potential impact might have other dimensions as well. For example, without this project, these four units would not be working together in quite the same way. Nor would we continue to trouble ourselves with this seemingly odd combination of units working together on behalf of the faculty, for the traditional ways of operating are rewarding enough. The challenge becomes even more complex when trying to transform a whole campus rather than just one individual faculty member. It means that each member must be able to see where each contributes, engage in meaningful dialogue, and all of us must continually ask of faculty and of ourselves: "What do you want your students to learn?" "Why?" "What do we know about the students' learning needs?" and so on.

Now, this team is dealing with something that is mostly unknown and constantly changing. The interaction involves the sharing of authority, expertise, and (yes) turf. Future success will depend in large part to the continued recognition that we are dealing not simply with providing technology services to the faculty, but that this effort is always in support of the teaching/learning process. Further, there is a need to understand more fully the dynamics of organizational change as well as the principles of faculty development.

Faculty development research literature suggests three forces that are most likely to drive faculty to change their practices:

- Intrinsic motivation is probably the most powerful. Participation is usually voluntary and we observe in our practice "good teachers who want to get better." Adding the technology tools to the teaching "tool kit" may serve learning better for many students.
- Teaching consultation services are a standard part of faculty development programs in many institutions. Providing additional consultation, which specifically addresses the ways technology can enhance instruction, may lead to better teaching and learning.
- A positive institutional climate for teaching may be the single most influential factor in efforts to improve teaching across an entire campus. A positive climate for use of technology in teaching can also be fostered by providing institutional supports.

Promising practices which offer to bring traditional faculty into this new era are those which appeal to the intrinsic values and beliefs held by faculty, which listen to faculty and help them answer the questions they have about their classroom practices, and which put support systems in place and make sure that faculty have learning partners for their development paths. Most faculty see teaching as their central role, they work hard at their teaching, take pride in it, and believe that the relationship between the student and teacher is central to learning. The reasons for studying most disciplines, such as chemistry, biology, history, literature or a second language have very little to do with technology. If, however, technology can contribute positively to the enhancement of what faculty and students do as they engage with each other in the learning process, and the concerns of faculty can be addressed in some effective way with the use of educational technology, then the mainstream faculty may adopt these new tools.

Finally, the experience at University of Delaware has shown that educational technologies, when supported by a far-sighted administration, has the potential to empower faculty to achieve classroom successes that none of us can anticipate. However, the faculty should continue to determine the curriculum, and the evolution of technology on our campuses should be dictated by the learning needs of students and faculty efforts to meet those needs. Therefore, the impetus should come from the teachers and students themselves, and they (not the technicians) should ask very tough instructional questions of the technology. Together with the technicians and their students, faculty will create the most imaginative uses for educational technology. Furthermore, comprehensive evaluations, particularly the inclusion of student evaluations of educational applications should help assess the pedagogical value of any innovations.

Library and Computing Merger: Clash of Titans or Golden Opportunity

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Abstract:
Many universities are merging knowledge organizations, primarily libraries and computing centers. Discussion typically includes the developing organizational structure, the impact of technology on the organization, and funding implications. One major issue facing these units is the merger of cultures that each brings to the new organization. This cultural merger can either be a clash of titans from which neither emerges intact, or it can be a golden opportunity to incorporate the best of each to produce a different organization with a new cultural value system. This paper describes the merger of a university library and campus computing organization with the best values of each.

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THE ENVIRONMENT

As Arthur P. Young noted in his introduction to the fall, 1994, issue of *CAUSE/EFFECT*, there is "...inexorable trend that is bringing libraries and information technologists into new and challenging forms of interaction."[1] The reasons for this convergence and/or collaboration are many and have been elaborated upon elsewhere.[2] [3] [4] [5] This paper will not discuss the many articles that have been published elsewhere on the rationale for this development.

As more universities have opted for a closer relationship between libraries and computing organizations, much attention has been paid to the issues of organizational structure and control, funding sources and implications, and organizational benefits that can be derived from such a partnership and/or merger.[6] [7] [8] [9] [10] [11] [12] However, relatively few discussions have included any mention of the cultural values that each group bring to the partnership and how those cultural values can either derail the collaboration/merger or enhance it. This is somewhat odd since, in our experience, this question of professional cultural values is one that can totally derail a new merger/partnership if not handled properly. As Diane Cimbala put it in her 1987 article on the scholarly information center, "...The staffs of existing libraries and computing centers may well resist such a change..."[13] Anyone who has ever been involved in an internal merger within an organization wherein the participants share similar academic backgrounds and values knows that, in this best case scenario, mergers are fraught with conflict and unresolved anger. When such a merger takes place between two different organizations with different professional values, the merger is in peril if a major emphasis is not placed on a merger of the value systems of the two groups involved.

It might be argued that accentuating the differences between the two organizations is not well-placed. Some have stated that, "...the main objective should now focus on exploiting points of convergence to advance campus information and technology agendas."[14] We would disagree about where the emphasis should be placed in the initial stages of merger. In her 1993 paper, "Creating A Virtual Information Organization: Collaborative Relationships Between Libraries and Computer Centers," Sheila Creth stated that "...the relationship between academic librarians and computer professionals has been one characterized by unease, caution, lack of knowledge and understanding, and occasionally outright mistrust."[15] This description of the relationship is accurate in more instances than probably most of us are willing to acknowledge. At a minimum, if there is both a library and a computing organization on campus, and they have a good working relationship, merger of the two organizations leads to a sense of loss for both staffs. What is that loss? Loss of identity with a group who has similar values and experiences perhaps or loss of prestige, power, autonomy or authority.[16]

Are the values of librarians and computing professionals so at odds? What do librarians believe in? What are the values they hold dear? The same questions must be asked of computing professionals.

THE VALUES OF LIBRARIANS

For non-librarians, the answer to the question, "Why do people become librarians?" will be answered with, "Because they like to read." While it is true that most librarians like to read, as I hope all educated individuals do, the real answer to that question is that librarians believe in service. To librarians, libraries are not primarily information or knowledge centers, they are service centers. This is absolutely a core value. The most damning thing you can say about a librarian is that he/she is not service-oriented. Librarians who are poor service providers are typically shunted off to back shop operations which have lower status within the profession and, which, as several research studies show, enjoy lower pay. How this service is delivered to the user depends on the user's status (faculty vs. student), the type of academic library (general vs. specialized branch), the level of funding it enjoys, and the expectations of its clients. This has often been a source of conflict between libraries and faculty who see the library primarily as a storehouse of books and periodicals and who want the money spent on these things; and, librarians who see service as their primary business and books and periodicals as one method for delivering service.

A second value of librarianship is that librarians love to work in groups. Most decisions are group decisions, and the decisions are typically reached by consensus rather than by voting. Academic libraries are a perfect reflection of the academic environment in which they operate because they operate typically by committee. Note we say committee, not task force. These groups may be called teams; TQM has been a big hit in libraries since it emphasizes the development of a team ethic. It is very important that everyone in the group agree on the decision. After a decision is made, an individual who goes off and does his/her own thing will be heartily condemned. It is important to adhere to the group's rules. As Creth has put it, "...librarians...experience a process of acculturation in which they develop a shared philosophy...they are more likely to act within the boundaries of accept professional beliefs and behavior, being less likely to act independently."[17]

The ability to work well together and the desire to provide excellent service to its users has led to cooperation between libraries as institutions that is not typically found in other groups.[18] Librarians have recognized for a long time that no one institution can hope to contain all the information that their clientele will need--so it developed interlibrary loan--and for a long time, that sharing of materials between libraries was without charge to the user. A desire to cooperate for the greater good led to the development of bibliographic utilities which were initially developed so libraries could share cataloging records, thus cataloging materials faster for their users at a cheaper unit cost. A library which refuses to cooperate with its peer institutions whether they are Ivy league, land-grant, or small liberal arts colleges runs the risk of becoming a pariah in its peer group and being deliberately left out of advantageous developments.

Because they have a deeply imbedded value of service and group decision-making, libraries have a very long tradition of user advisory groups. This can be more clearly seen in public libraries where every public library system in the United States has a public library board, sometimes advisory, but often with legislative or regulatory authority. In academia, almost all college and university libraries have library advisory committees populated primarily by faculty, all of whom have a better idea for running the library than the librarians. And, they are seriously listened to! A university library director who ignores his/her library faculty committee does so at the peril of his/her position.

Another value that is strongly held in the profession of academic librarianship is the value of training users to become self-sufficient. Many librarians believe that the primary function of the academic reference desk is to train the user to use the tools of the library, rather than answering the question asked. This, of course, varies depending on the type of question (How many dimples on a golf ball? will usually elicit a direct answer), the status of the questioner (faculty resist being taught anything, especially when they already know how to use the library), and the amount of time to devote to the teaching/learning opportunity (a line of 7 people waiting for the librarian is not conducive to a leisurely explanation of how to use the on-line catalog).

This emphasis has led to the development of bibliographic instruction, which is librarianship's attempt to introduce the library research process into a discipline-based course. For those of you who not librarians, bibliographic instruction is teaching students how to use the library's resources in a particular discipline, such as history, while they are enrolled in a history course which requires library usage. Librarians also teach stand-alone courses that concentrate solely on teaching good library research practices in a general context. However the instruction is delivered, the goal is to make the library self-sufficient for most library needs.

Another distinguishing characteristic of librarians is the tendency to be perfectionists. They are not only service-oriented; they want to deliver perfect service. A complaint from a user will often cause a flurry of self-examination and self-recrimination. For example, in our special collections area which has been rated world-class in its area of specialization, a faculty member may complain that she did not find one book out of 25 she was seeking. The bibliographer will often spend quite some time investigating how we could have missed that one book and try to determine if this one instance is symptomatic of a larger service failure. Librarians will focus in on the glass half empty, rather than half full any day.

The good side of this perfectionist tendency is that librarianship as a profession has been using profession-wide standards for over 100 years. The card catalog looks the same United States-wide because of a decision around the early 1910s at the Library of Congress to institute a "unit" card. Almost every library in the country, with some notable exceptions, followed suit, and thus, almost every library in the country had uniform card catalogs. When librarianship introduced computing into its processing and acquisition activities in the mid-1960s, it was totally natural and in congruence with its professional values to embrace the standardization of electronic bibliographic records. This made possible the development of on-line systems and bibliographic utilities long before most mainstream computing had begun thinking about standards.

Now, of course, like all good things, librarianship has elevated having a standard to that of the false Golden God. Some might argue, to good effect, that standards are impeding the fast delivery of information which is rapidly becoming an expectation of our client base.

A logical extension of the desire for standards (overlaying its desire for perfection) is that developments in librarianship have typically involved a long, slow development path. The way in which librarians catalog information is governed by a standard--called the Anglo-American Cataloging Rules. When it was decided that these rules (familiarly known as AACR) needed to be updated, the new rule formulations which was handled by an oversight committee of the American Library Association, took years to be completed. When AACR2 came out, most librarians were stunned by the radical changes contained it them; a few librarians were stunned by how conservative the change had been! This is a perfect example of perfectionism, needs for standardization, and a long, slow development path that is characteristic of librarianship.

In reviewing the values of librarianship--orientation to service, group-oriented work, a high value and use of cooperation to reach goals, use of groups to advise development, training/teaching, perfectionism, and standardization--one might say that these are attributes of one particular group and that group is women. Librarianship is still, by and large, a profession of predominately females. This is not a point that is usually made in exploring the merging of libraries and computing organizations, but it must be faced if the merger of the two organizations is to be successful. It is not politically correct to say so in the academic climate of today, but women (and, again, we realize that we are indulging in a generalization that will not hold true for all individuals in the profession) bring a set values to a profession that help set the tone for the profession. This tone has led librarians to being considered extremely trust-worthy, but typically, low paid.

THE VALUES OF COMPUTING PROFESSIONALS

We now have established the value system of librarianship. What values are important to the university computing profession? Please note that we don't really have a "name" for the computing professional. We call the professional staff of the library, librarians, but computing professionals don't really have a moniker. This is significant because it may signify that computing professionals have little in the way of central core educational and experiential backgrounds.[19] They do not share common professional and academic experiences--don't go through a common molding experience that helps to develop a shared professional philosophy. Computing professionals may appear on the scene with a degree in computer science, but they are just as likely to have a degree in telecommunications or engineering or business or physics or philosophy. The end result is that, as computing professionals, we prize individualism and the ability to act independently. While libraries, as we said earlier, tend to act within commonly understood boundaries, computing professionals are much more likely to prize entrepreneurship. If a computing professional disagrees with a currently held view, it just proves he/she is visionary.

Since librarians value the ability to work in groups, its leaders tend to be individuals who can bring people together, or, as Isaiah 1:18 said, "Come now and let us reason together." Computing professionals tend to focus on the charismatic leader: strategic, decisive, visionary, entrepreneurial. One author likened the Chief Information Officer (which is the equivalent of the library director) as Rambo of the Information World.[20] It might even be safe to say that the Rambo CIO has more than an touch of ego in his/her decisions and strategies. Because CIOs tend to be Rambo-like, they move on fairly frequently--once you get past the initial thrill and hype of constant "war," it's hard to build a long-term relationship with an institution unless the CIO segues to a more managerial model--something very hard to do. As a result, compared to librarianship, there are frequent changes of leadership. Coupled with a lack of commonly held academic preparations and experiences, computing organizations tend to be highly volatile and dynamic. This tendency is, of course, exacerbated by the highly evolving nature of technology itself.

Another value of the computing professional is to be oriented to the machine and/or software and not to the end user who uses the box and software. Another way of saying this is to say that computing organizations are very technologically oriented.[21] We think it is fair to say that, while librarians place the emphasis on service to users, computing professionals put the emphasis on service to the technology. This is understandable since technology is not easy to use (from the end-user perspective) and, as the drive to make it easier for the end-user accelerates, it makes the technology even more complex for the computing professional.

Having said this, however, it is hard to imagine being asked in a library meeting, "Just how far do we have to go in helping the user?" We have been asked this question in a computing meeting, and the various responses from computing staff have been vigorously debated and questioned. It is partially, of course, a matter of resources--none of us really has an adequate resource base and the expectations of our clientele are rising. Nevertheless, it has been well-noted by the profession that "...computer people felt they alone knew best what their clients needed and thus were very non-responsive to the community they should be serving."[22]

One of our computer technicians who follows up on calls to our Help Desk has expressed concern about the arrogance he sometimes sees on the part of the Help Desk staff toward users who call in with problems. Granted, some of these problems are really dumb and the caller should exercise a little more responsibility in running his own technology (like making sure it's plugged in), but this is a problem shared by librarians at a reference desk. It denotes more what one author called the priesthood of computing.[23] Since the early days of computing, there has been a struggle in the profession between those who "...were..unalterably opposed to those revolutionaries who wanted to make programming so easy that anyone could do it." [24] This argument sounds strange today, but remnants of the debate linger on in the support often given to the end-user.

The view from the user perspective that computing organizations are typically non-helpful to end users is exacerbated by the fact that three computing staff studying the same problem will have three different solutions to the problem--which each will defend to his/her dying breath. A faculty member from physics recently told us that when he has a computing problem he can't solve, he will ask the electrical engineers, the college computing technician, and our help desk and get three different answers. His plaintive question to us was, "...Who do I believe?" The religious wars of computing are virtually unknown in librarianship.

This conflict over the best methodology or technology to accomplish a goal is linked to another value of computing: the conflict over standardization. As one author put it, "...A primary difference is that libraries are struggling to incorporate the computer within their long tradition of consistency, while computer centers struggle to develop some consistency in a climate of constant change."[25] This is easily understood, of course, because the environment in which information technologists have worked has been, to say the least, volatile. This has made it very difficult for the computing profession to develop and maintain standards. In some instances, there has been very little understanding of the need for adherence to standards once the standard has been established. This is partially driven by the entrepreneurial behavior and creativity often exhibited by the computing professional.

Along with the slow development of standardization has been the desire to get developments out on the street quickly with a higher value being shown for speed of delivery and a lower value shown for quality of product. We have literally never received a software upgrade for our on-line catalog vendor without receiving shortly thereafter a patch tape and, usually, several patch tapes. Those of you who are in computing will not find this an extraordinary observation--this kind of thing drives librarians absolutely wild. Librarians as a group usually will not deliver a service or product until it has been tested, retested, and verified once again. Here, the computing professional is probably closer to what the end user expects--today, in libraries and in computing organizations, the user wants it now, wants it yesterday, wants it before he/she thought of wanting it!

Computing organizations tend to be very aggressive. The experience that Sharon had the first time that she went to a computing meeting after the merger was eye-opening. The group began to argue fiercely about some issue, talking over one another, yelling out their ideas, and generally had a verbal fisticuffs. Finally, to get a word in edgewise, Sharon stood up and yelled, "Everybody shut up and listen, I want to say something." The interesting part of this story is that no one resented her for doing that, and, in fact, she gained a measure of credibility because she was willing to engage in the verbal fistfight.

The language that the two groups uses to essentially describe the same event is reflective of their two cultures. Computing language tends to be aggressive and war-like. Librarians tend to use words which emphasis harmony and group processes. Examples include: computing uses "end-user,"; librarians use "patron." Computing says "execute routine and terminate processes;" libraries "lend and borrow." Computing "hacks a program;" librarian "search for information." Many more illustrations could be made.

The values of individualism, independence, decisiveness, entrepreneurial, aggression, and being oriented to the technology are attributes, in general, of one group and that group is men. Just as librarianship is female-dominated, computing tends to be male-dominated. Again, we acknowledge that there are women who are highly independent, decisive, entrepreneurial, and aggressive, but we maintain that these attributes are generally consider to be, rightly or wrongly, masculine. So while libraries are typically passive-aggressive in the way they operate, it can be said that computing organizations tend to be very aggressive or macho in the way in which they operate.

MERGING THE TWO CULTURES

It should go without saying, but we will say it anyway, that, in order for the two organizations to merger, they must first come to know one another and to appreciate the positive values that each brings to the organization. How do you go about doing this? We do not have the definitive answer, and, in point of fact, will probably never have the definitive answer as organizational development is always in a state of change. Nonetheless, we proffer the following thoughts.

First, name the problem. Four days after the Provost of the university announced the merger of computing and libraries, Sharon held a convocation of both staffs and lined out why she believed this was a positive development for both the library and for the computing organization. She also lined out the problems that she believed needed to be solved before a true merger of cultures could take place. She pointed out that it would not be easy--and it would not be fast. Candor is often rare in higher education--it can be a great tool for building credibility because it is so often underutilized.

We both met with the computing staff and carefully defined our individual managerial styles and how we approached problem-solving and personnel management. It is crucial that the managers, whether it be the director or associate director or the department head, be self-reflective enough to know their own management styles and values and communicate them to the staff. The staff don't have to like or agree with them, but they do need to know what they are. Once we had laid out our values, the staff of both the library and computing tested us to see if we walked what we talked.

Next, you must find ways of bringing the staffs together in ways that are structured to be positive. Every librarian who has ever worked with a computing person can tell you how they promise and don't deliver, how it never works completely right, and how they never show up when they say they will. Every computing person can tell you how demanding librarians are, wanting to know every last little detail and how they insist on every "t" being crossed and every "I" being dotted. So, you have to structure opportunities for them to know one another outside the heat of the battle.

In the library, we have had a library-wide coffee hour on the last day of the month for some time. It is the only time we all actually get a chance to see one another and to visit about our lives and our work and award the Employee of the Month award to the selected individual. Each department takes a turn hosting the event--and bringing the food. Librarians love to cook and, typically, the food at these events is outstanding. The food got computing to come, because they love to eat. When their turn came to host the coffee hour, they were terrified because they knew they couldn't compete. We suggested that they play on their strong suit and provide the stereotypical food associated with computing. So, we had pizza and cokes. The library staff loved it! The computing staff felt accepted, especially when one of the computing staff members was selected as Employee of the Month in the first few months after the merger.

We also decided to upgrade the computing infrastructure of the Library which had been wired over a number of years using whatever standard was in place at the time (if indeed a standard existed at the time). We also decided to redesign the network typology of the library. We called upon the computing staff to carry out the work. They began with more than a touch of arrogance. As our resident networking guru told me, "This will be a piece of cake compared to other things we've done." Well, it wasn't a piece of cake. It was challenging and frustrating and required them to think hard about what we were trying to accomplish. In other words, as they began to directly support the library's daily computing activities, they began to respect the complexity of the library's need to deliver a high volume of information over a network. And, conversely, as the library's ability to do good work improved with the new wiring standard and the networking topology, the librarians began to appreciate the value that the computing staff could bring to the tasks before us.

The librarians brought their strong service orientation to the merger, and this has directly influenced the development of computing services. We have doubled the number of lines coming into the Help Desk, have increased hours that the calls are taken, and have set benchmarks for service provision. While initially skeptical, after working some time on the Help Desk, most computing staff developed a better orientation to serving the user. For their part, librarians trained the individuals who staff the Help Desk in interview techniques and question negotiation. We don't wish to imply that this problem has been solved and that the new motto of computing is "Service R Us." This is far from the case. But, the question of service to the end user is being debated and discussed. At a minimum, the question of end-user services is now a topic of keen interest on their part, and they are coming to see that their success or failure as an organization rests upon our ability to meet the needs of our users.

Having said this, we believe that computing can influence librarians not to go into a tail spin every time there is a complaint about service. You know the phrase, women who love too much--well, we have librarians who do too much. If we truly believe in self-sufficiency for the user, we have to encourage that self-sufficiency.

Has there been any impact upon librarians from the merger? Yes, and the impact actually has been more problematical than it has been for the computing division. Before the merger, the library has its own computing staff--small in numbers but they were "ours." When the campus computing organization was merged with the library, we merged the library computing staff into the overall division. We think it would be fair to say that most librarians feel a sense of loss over this merger within the merger. It would also be fair to say that this sense of loss comes from a loss of control. Can we really trust those computing guys to support our needs?

The perfectionism of librarianship has caused many to have too high a standard for computing support. Coupled with almost classic passiveness in the face of technology has caused one of our computing staff to say that, "Boy, librarians sure are a whiny bunch." We would have to agree in this instance. Librarians must take more initiative in the face of new technology, because not only must we use it, we must teach it. We hope to inject some of the aggressiveness, entrepreneurialism, and decisiveness exhibited by computing into the library staff. Computing staff typically exhibit a high level of risk-taking--librarians could use a dose of that.

Having said all this, is it hopeless? Are there no similarities between the two groups that can be used as a foundation for building our new culture? Happy to say there are. One of the wonderful characteristics about the computing culture is their insistence on all users having open access to resources; librarians have been a bulwark in the print world against those who would restrict access to information. This is a value under assault in our society; it may indeed take us both working together to maintain open access to digital, print, and other formats in which information comes these days. We are both involved with information at a meta level; neither really cares about the bit level or the transaction level. This calls for a different type of management skill than other groups who work with information. And, finally, we have subgroups within the larger group with similar interests and personality characteristics--computing has programmers and librarians have catalogers.

We hope we have shown what the values of librarians and computing professionals are and how they can complement and clash. The truth is we can dwell on our commonality, or we can emphasize our uniqueness. Today, and even more in the future, "...both computing centers and libraries will be faced with challenges which will tax the fiscal and human capacities of both."[26] We will prosper together, whether it is a merger or a collaborative effort, but we will certainly die separately.

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CAUSE
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9

FOCUS SESSION

5th Annual Strategic Planning Assumptions Update

IT Staffing Issues

CAUSE95
Realizing the Potential of
Information Resources
November 30, 1995
New Orleans, Louisiana

Grey Freeman
Gartner Group

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What forces are causing IT organizations to change IT human resource practices?

Forces Causing Changes in IT Human Resource Management

- Changing Application Technology
- Changing Role of IS
- Increased User Service-Level Expectations
- Sensitivity to Full-Time Head Count
- Lack of Internal Skills
- Market Demand for Highly Prized IT Talent
- Move Toward Employee Empowerment
- Changing IS Business Model
- Corporate/IS Downsizing

There are a number of forces that are fundamentally reshaping the way organizations manage IT human resources. Some of these are external market forces (e.g., the changing way that IT personnel are employed); some are internally fueled forces (e.g., lack of investments in the human infrastructure over the past number of years); while others are fueled by the changing IT technology base. Regardless of where the pressure is coming from, every organization is feeling the pressure to re-engineer.

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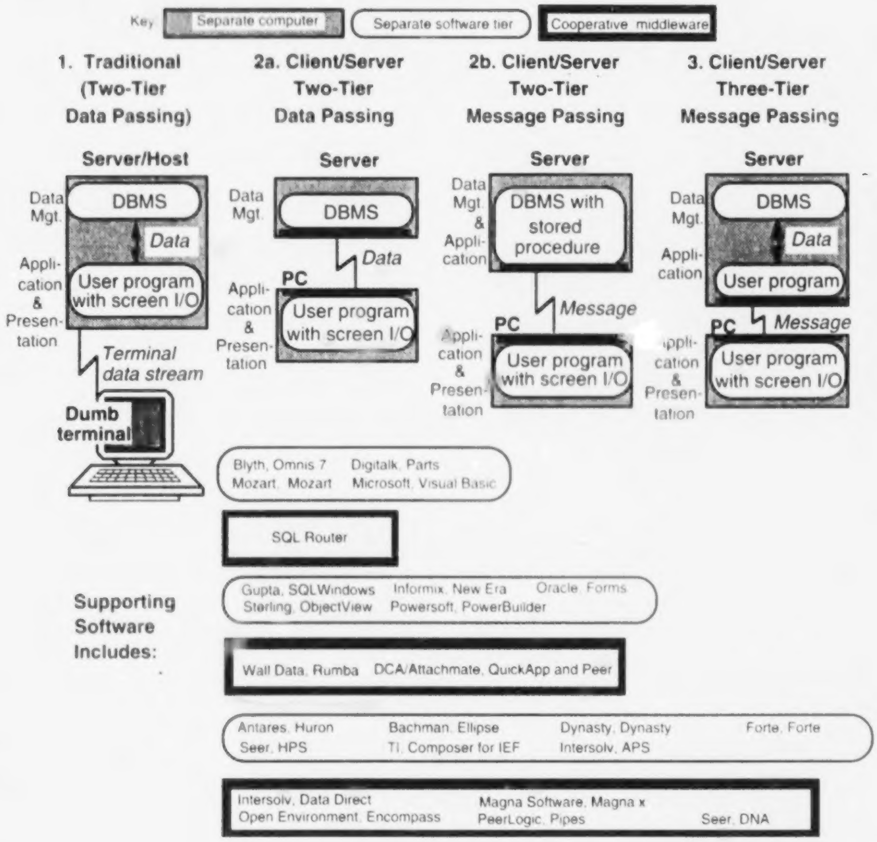
Reader Notes

Strategic Planning Assumption

By 1996, multitiered architectures will be used in more than 50 percent of enterprise client/server applications to simplify end-user environments, maximize performance and handle security and management (0.7 probability).


Key
Separate computer
Separate software tier
Cooperative middleware
1. Traditional (Two-Tier Data Passing)
2a. Client/Server Two-Tier Data Passing
2b. Client/Server Two-Tier Message Passing
3. Client/Server Three-Tier Message Passing
Server/Host
Data Mgt.
DBMS
Data
Application & Presentation
User program with screen I/O
Terminal data stream
Dumb terminal
Server
Data Mgt.
DBMS
Data
PC
Application & Presentation
User program with screen I/O
Server
Data Mgt & Application
DBMS with stored procedure
Message
PC
Application & Presentation
User program with screen I/O
Server
Data Mgt.
DBMS
Data
Application
User program
PC
Message
Application & Presentation
User program with screen I/O
Supporting Software Includes:
Blyth, Omnis 7 Digitalk, Parts
Mozart, Mozart Microsoft, Visual Basic
SQL Router
Gupta, SQLWindows Informix, New Era Oracle, Forms
Sterling, ObjectView Powersoft, PowerBuilder
Wall Data, Rumba DCA/Attachmate, QuickApp and Peer
Antares, Huron Bachman, Ellipse Dynasty, Dynasty Forte, Forte
Seer, HPS TI, Composer for IEF Intersolv, APS
Intersolv, Data Direct Magna Software, Magna x
Open Environment, Encompass PeerLogic, Pipes Seer, DNA

Source: Gartner Group

Key Issue: How will Client/Server Computing evolve over the next five years?

The complexity of many-to-many access requirements and business flexibility, combined with mainframe, PC and departmental legacy systems, will engender the need for multitiered architectures. Communications between clients and various servers may become quite complex, requiring extra work for the user or an extremely robust client. The limitations of current desktop systems make this complexity impractical to implement broadly without creating performance or management problems. An infrastructure tier between client and server application segments can offload multisource, multitype data retrieval problems; format conversions; networkwide access and routing; authorization; and message and workflow management. Separation of infrastructure services from application services can help simplify resource optimization and performance management.

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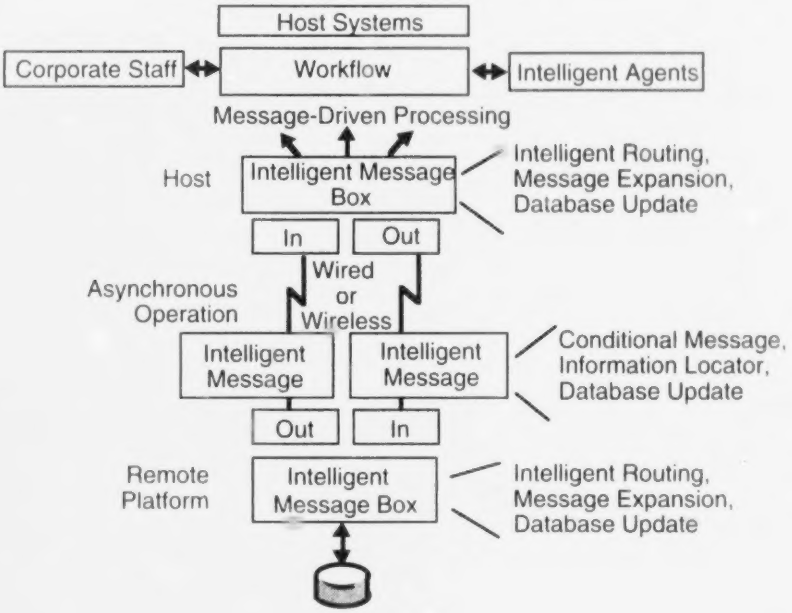
Mobile-computing requirements will force a shift toward message-based client/server middleware for many applications, limiting the long-term usefulness of remote procedure call (RPC) technology (0.6 probability).

Reader Notes

Intelligent Messaging Architecture


Host Systems
Corporate Staff
Workflow
Intelligent Agents
Message-Driven Processing
Host
Intelligent Message Box
Intelligent Routing, Message Expansion, Database Update
In
Out
Asynchronous Operation
Wired or Wireless
Intelligent Message
Intelligent Message
Conditional Message, Information Locator, Database Update
Out
In
Remote Platform
Intelligent Message Box
Intelligent Routing, Message Expansion, Database Update

Source: Gartner Group

Key Issue: How will Client/Server Computing evolve over the next five years?

Today's client/server architectures are ill-equipped to handle the needs of the mobile user who is intermittently connected and who demands, for productivity reasons, that electronic mail, database access and document transfer occur during a single session. To send or retrieve this information, these mobile users must be online, wasting expensive communications resources as well as their own time. New types of messaging technology are emerging that will increase the capabilities of client/server applications to accommodate mobile users.

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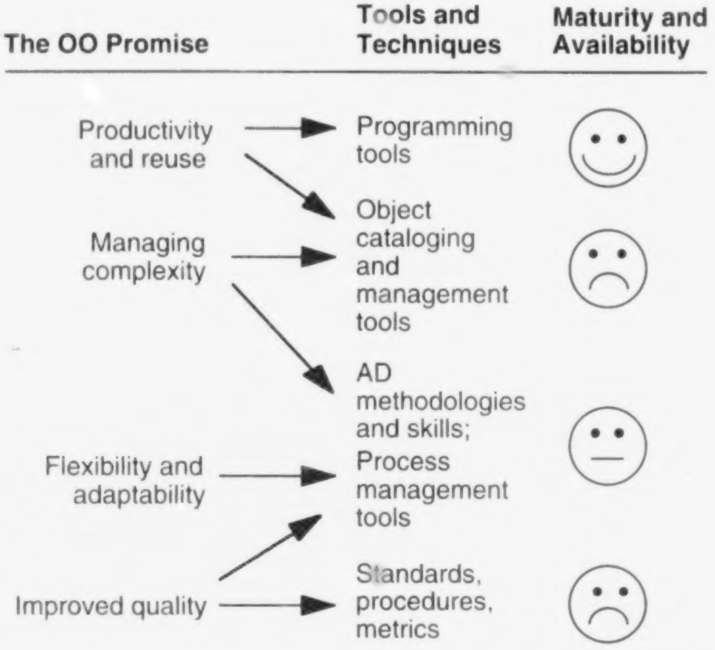
Strategic Planning Assumption

By 2000, at least five in 10 new applications will use object technology for user interfaces and complex client and server functionality (0.7 probability).

Object-Orientation: Promise vs. Reality


The OO Promise
Tools and Techniques
Maturity and Availability
Productivity and reuse
Managing complexity
Flexibility and adaptability
Improved quality
Programming tools
Object cataloging and management tools
AD methodologies and skills; Process management tools
Standards, procedures, metrics

Source: Gartner Group

Key Issue: How will Client/Server Computing evolve over the next five years?

"Class objects" (in object-oriented paradigms) can significantly lower the technical barriers to software reuse. Component objects do less in this regard, but will be useful in leveraging and managing off-the-shelf functionality. In either case, object reuse cannot be achieved unless objects can be described, stored, browsed, searched and retrieved effectively. However, powerful object/component repositories, coupled with supporting integrated toolsets, will not be available before 1998 (0.8 probability). Such object-management technology lags far behind object-development technology and will remain one of the major technical barriers to this type of reuse. Other barriers to software reuse will include cultural, organizational and political hurdles that may ultimately prove far more daunting for many organizations than any technical challenges.

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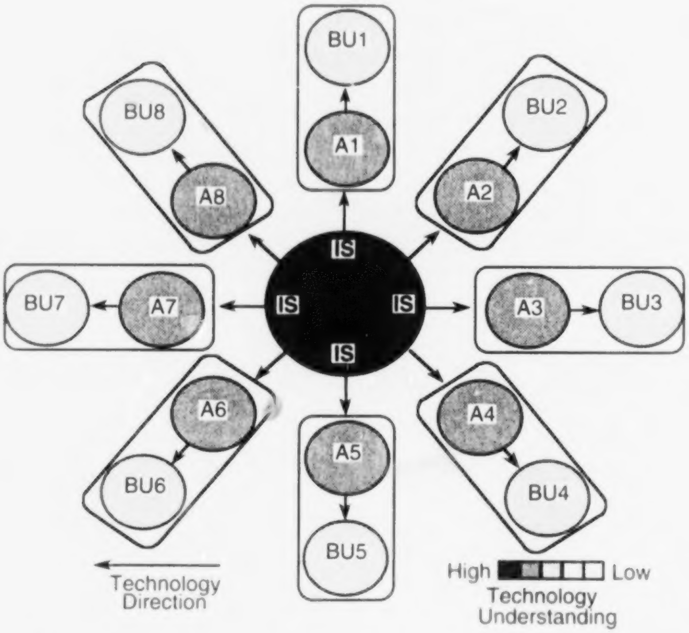
Reader Notes

By 2000, 70 percent of all new applications will be developed by business unit developers outside of IS, often in close collaboration with IS professionals providing specialty skills when required (0.8 probability).

Coordinated Hybrid AD Organization



Source: Gartner Group

Key Issue: How will the role of IS evolve over the next five years?

Applications development has exploded well beyond the scope of most IS organizations' ability to control it. Low-cost tools and new development technologies hold promises of rapid solutions deployment for BUs long frustrated by IS' inability to deliver quickly on their requirements. As a result, these tools are filtering into decentralized BU organizations at a dramatic pace. While such tools may provide immediate term, localized benefits at the BU level, in aggregate, they threaten to dismantle any architecture and/or infrastructure that the central AD organization attempts to install across the enterprise. The potential for architectural chaos and technology churning, at great expense to the enterprise, is enormous.

Central AD organizations, having lost the ability to control these disparate efforts, must find new ways and new organizations to bring together these potentially competing objectives.

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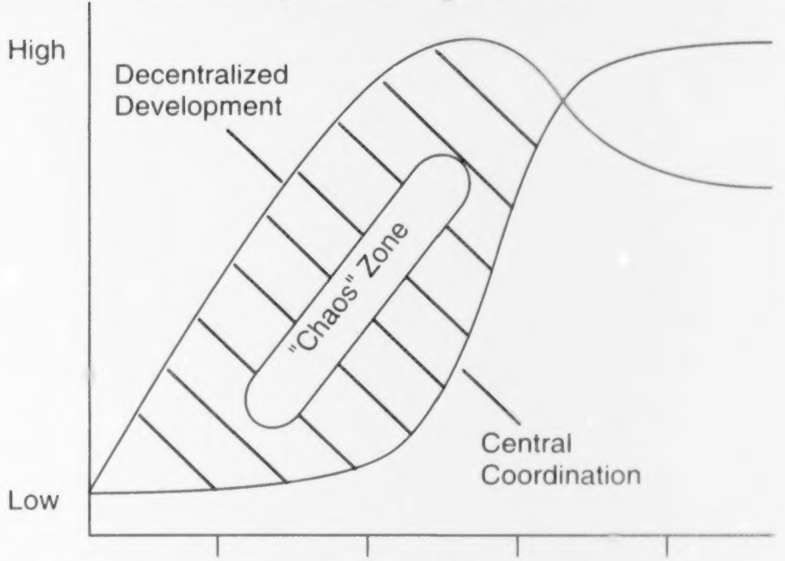
Strategic Planning Assumption

9-1-7

Reader Notes

By 2000, all effective IT organizations will provide central coordination of decentralized AD activities, either through internally managed infrastructure and specialty centers or through selective outsourcing (0.6 probability).

Coordinated Hybrid AD Organization



Type A	1994	1995	1996	1997	1998
Type B	1996	1997	1998	1999	2000
Type C	1997	1998	1999	2000	2001

Source: Gartner Group

Key Issue: How will the role of IS evolve over the next five years?

Decentralization of the development effort will continue to outpace the organization's ability to support these efforts through central coordination. Central coordination will lag, but will be critical in achieving the overall objectives of the enterprise. During the period of chaos, where sufficient central coordination is unavailable, some form of outsourcing will be the only answer for many organizations. Type A organizations will be likely to use "selective" outsourcing, e.g., specialty centers, to bring critical skills and transition technology strategically into the organization. Type C organizations are more prone to outsource for cost efficiencies and may choose to outsource major portions or even all of the AD effort. Type B organizations may find themselves on a perilous fence — with too much invested to outsource the entire AD effort, but too little knowledge and/or maturity to know what or how to outsource selectively.

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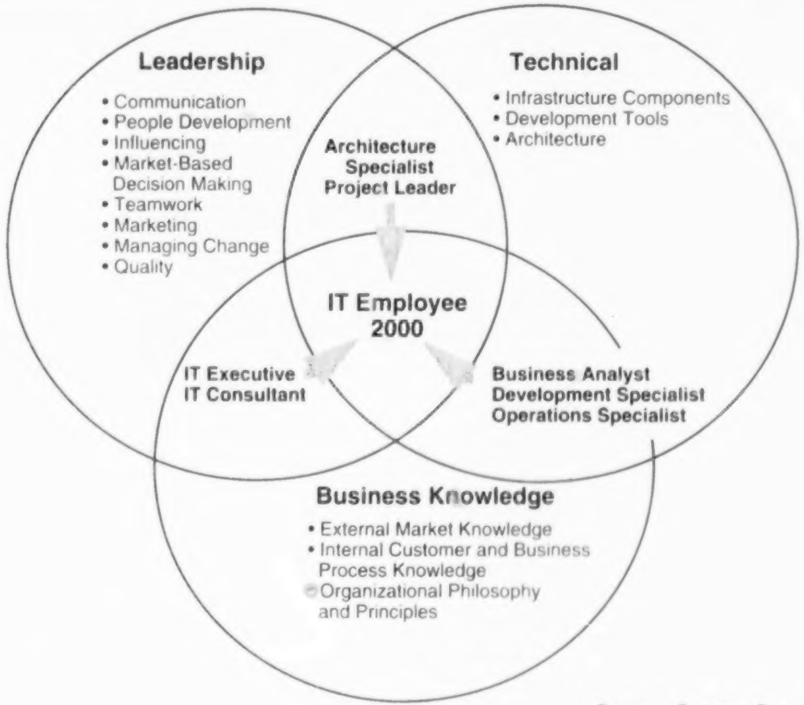
Leading IT organizations will enhance the alignment of IT with client needs, mitigate IT resource constraints and develop more highly adaptable IT professionals by developing IT skill sets that encompass knowledge of the business, technology and leadership.



Leadership

- Communication
- People Development
- Influencing
- Market-Based Decision Making
- Teamwork
- Marketing
- Managing Change
- Quality

Technical

- Infrastructure Components
- Development Tools
- Architecture

Business Knowledge

- External Market Knowledge
- Internal Customer and Business Process Knowledge
- Organizational Philosophy and Principles

Architecture Specialist Project Leader

IT Executive IT Consultant

Business Analyst Development Specialist Operations Specialist

IT Employee 2000

Source: Gartner Group

Key Issue: How are IT work roles changing?

The first phases of client/server adoption saw organizations do little with IT professionals performing traditional jobs other than to have them perform the same task (e.g., programming and systems analysis) with a new toolset. In some cases, organizations pushed IT professionals to become "deep specialists" in one area of client/server (e.g., GUI design). Increasingly, leading IT HR practitioners are evolving toward more complex work roles (groups of skill-work roles) rather than increased specialization to develop an IT employee that is highly adaptable and business-aligned. In this new role, IT employees will have breadth of knowledge in key areas (e.g., leadership, technical and business), as well as specialties in certain areas. This will lead to greater resource optimization and a more well-rounded IT worker.

Organizations face two key questions in developing hybrid workers. First, can employees with broad-based knowledge achieve mastery? Second, how difficult will it be to retain these high-powered individuals? Regardless of these unknowns, organizations that fail to loosen the straitjacket of "job descriptions" and narrow skillsets will lose competitiveness (lack of adaptability).

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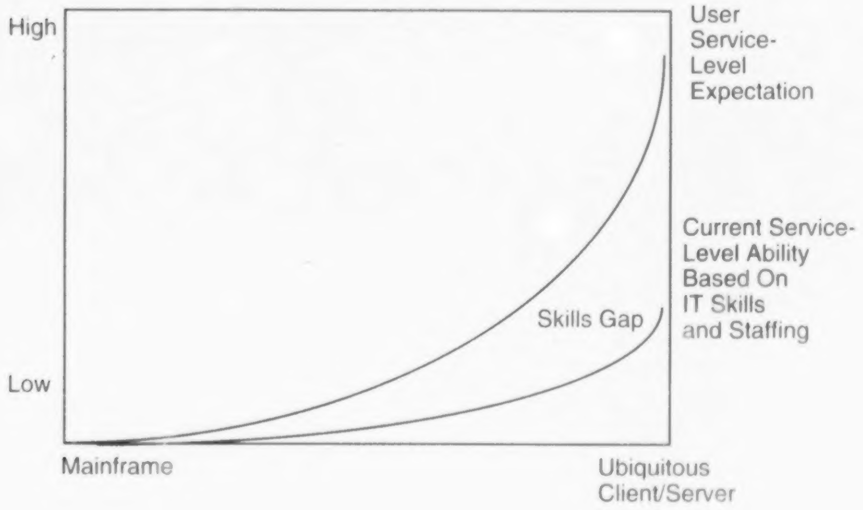
Reader Notes

User service-level expectations will fuel organizations to enhance IT professional skills quickly almost eliminating the effectiveness of novice-level personnel and forcing massive reinvestment in existing personnel or further outsourcing of IT functions.



Source: Gartner Group

Key Issue: How are IT work roles changing?

The very nature of client/server raises user service-level expectations beyond the capabilities of IT professionals' abilities to address these expectations. What this means for IT is that it must re-engineer its jobs and build entirely new skillsets to support the new position. A good example are best-in-class help desks that target 90 percent call retirement in 10 minutes or less on the first call. To achieve such a service, objective organizations *must* have a journeyman or expert resource available whenever a customer calls. This runs contrary to the typical skills profile of help desk analysts whose skills do not allow them to retire a call but rather to log and dispatch the call to a Tier 2 resource.

Once again organizations face significant HR challenges in moving all IT employees toward mastery. The cost to retrain and maintain mastery skills may require a $10,000 to $20,000 per year per employee investment during the short-term (three years) planning horizon. Management will have to carve out time for employees to continually improve existing skills and acquire new ones. Retention also becomes an issue as organizations may have to pay significant premiums (10 percent to 25 percent above standard IT pay rates) to retain highly prized employees.

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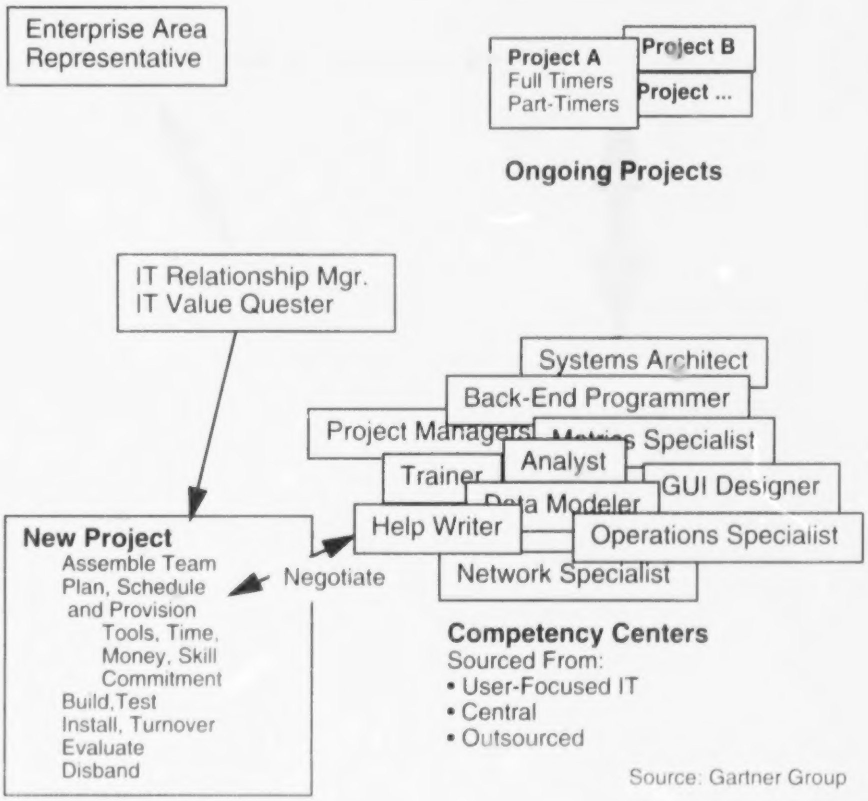
Reader Notes

IT organizations will optimize IT service delivery and increase business flexibility through a staffing model that emphasizes just-in-time IT work roles vs. full-time "jobs."



Enterprise Area Representative

Project A
Full Timers
Part-Timers

Project B

Project ...

Ongoing Projects

IT Relationship Mgr.
IT Value Quester

New Project
Assemble Team
Plan, Schedule and Provision
Tools, Time, Money, Skill Commitment
Build, Test
Install, Turnover
Evaluate
Disband

Negotiate

Systems Architect
Back-End Programmer
Project Managers
Metrics Specialist
Analyst
Trainer
GUI Designer
Data Modeler
Help Writer
Operations Specialist
Network Specialist

Competency Centers
Sourced From:
- User-Focused IT
- Central
- Outsourced

Source: Gartner Group

Key Issue: How are IT work roles changing?

Visionary IT organizations are moving away from traditional jobs to emphasize complex work roles. Jobs have been described to match a headhunter or a pay grade. With work roles the emphasis is on hiring needed skills. Work roles, therefore, can be less than — or greater than — 1.0 FTE per year. Hiring decisions — the choice to pay a person for 1.0 FTE's salary this year — should be made because of what this person brings as a permanent part of the organization, not because they "fit" a building-block job. Work roles allow for better, tighter matching of organizational needs against outside resources, paying for role fulfillment rather than hours worked. This is much more effective in a time when organizations are very head-count sensitive. Last, jobs take on a life of their own, compromising organizational change. In an ever-changing paradigm for IT work (e.g., COBOL ≠ GUI), companies will try to retrofit jobs to deal with the incumbent problem (exacerbated by the fact that the incumbent manager's position is typically a roll-up of a subordinate role), slowing needed change to keep pace with market changes.

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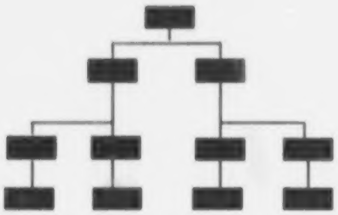
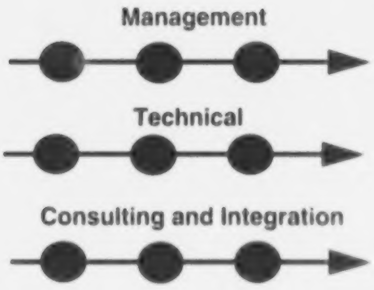
IT organizations will be forced to redesign IT employee career paths to retain key IT employees and improve staff morale.



Hierarchical

- Traditional technical into management career path
- Managers hold the stature and receive greatest rewards.
- Suboptimizes employees' strengths by mismatching employees' skills with work to be performed.



Teamed

- Alternative career paths into technical, management and consulting or integration areas.
- Stature and rewards offered to those who excel in chosen career path.
- Gives employees incentive to pursue excellence in their specialized discipline.

Source: Gartner Group

Key Issue: How are organizations re-engineering IT professional career paths?

Traditionally, IT organizations have set up a linear path for IT employees to enhance their careers. One started at the bottom and moved from a technical discipline into management. With the move up the career ladder came greater recognition, stature and compensation. However, management downsizing has created fewer upward opportunities into management. Also the traditional structure tended to suboptimize people's talents. Some outstanding technical personnel saw their only "career growth" path being into management and, therefore, pursued this path only to find out that they were not cut our for management and/or did not like the job of managing others.

Leading organizations are re-engineering career paths to offer those who wish to stay within the technical realm the ability to grow their skillset, compensation and organizational influence without having to forsake their technical competency or leave work they truly enjoy. Not only should organizations set up career tracks for technical and management professionals, but they should also develop internal consultants and integrators as a third career path group as these value-questing positions offer high payback to IT.

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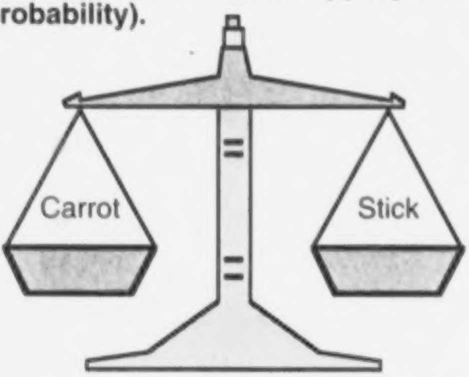
Strategic Planning Assumption

Reader Notes

To develop a sense of market responsiveness among IT professionals, IT management will increasingly implement market-focused reward systems to give incentive to employees. However, most of the effectiveness of these programs will be diminished because of IT's resource-poor state and the inability of IT and their customers to define appropriate service-level measures (0.6 probability).



Traditional IT Incentive Plan	Re-engineered IT Incentive Plan
• High fixed salary ≥95 percent of overall compensation	• Lower fixed salary ≤75 percent of overall compensation
• Bonus payment tied to internal measures	• Bonus payment tied to "market performance"
• Objectives are personal	• Objectives include enterprise, workgroup and personal goals

Source: Gartner Group

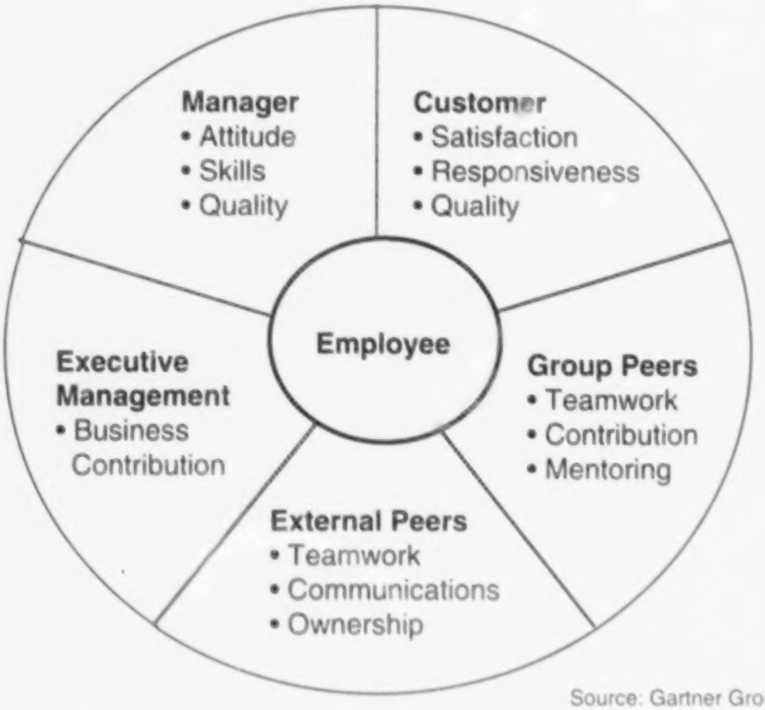
Key Issue: How are reward systems for IT professionals changing?

IT professional compensation systems have been out of synch with market needs for quite some time. They have traditionally rewarded clannish behavior not market behavior, as the average IT staff member and middle manager has not been market accountable. Leading IT organizations are re-engineering IT compensation systems to put more "incentive" in IT jobs, by increasing variable pay, while at the same time measuring IT pros based on market-centric service objectives and business contributions. An effective market-based compensation system will also help to mitigate the argument over resource ownership. The key to performance lies not in who one reports to but in to whom one is accountable.

There is one challenge for market-based incentive systems. Most IT organizations are understaffed to meet customer service "expectations." During the client/server revolution, IT organizations have seen their "real" head-count growth stay flat while service expectation has increased geometrically. IT's ability to meet market requirements has been compromised. Those who evaluate IT may feel that it is incompetent when in reality they lack the firepower to "do the job."

Even given its limitations as an appraisal methodology, organizations will increasingly turn to a 360-degree review process to gain insight into employees' performance and areas of needed improvement.

Reader Notes



Employee

Manager
- Attitude
- Skills
- Quality

Customer
- Satisfaction
- Responsiveness
- Quality

Group Peers
- Teamwork
- Contribution
- Mentoring

External Peers
- Teamwork
- Communications
- Ownership

Executive Management
- Business Contribution

Source: Gartner Group

Key Issue: What are the trends in the appraisals of IT professionals?

IT managers are increasingly pushing decision rights to workers to create organizational wealth. In doing this, the average manager loses visibility in a "heads down" world. To increase that visibility organizations are increasingly using 360-degree reviews as a mechanism to gain a fuller perspective on employees' work. The 360-degree review also supports collaboration and teamwork and should be used as a mechanism for team improvement.

In certain cultures, the 360-degree review process does not work (i.e., cut-throat cultures) and other methods must be applied. But, in the short term, we believe that this process will help to enhance a market-orientation and business-first approach on the part of IT pros.

Imperative

Reader Notes

To leverage scarce training funds and improve staffing responsiveness, organizations should implement skills-based management programs.

Skills-Based Management Process

Visioning	Analysis	Prioritize	Implement	Measure
Identify IT Vision and Role	Define New IT Work Roles and Needed Skills	Develop Sourcing Strategy	Develop or Select Target Courseware	Assess Effectiveness
Develop Technology Forecast	Catalogue Current Skills	Identify First Wave of Employees to Be Reskilled	Identify Needed Delivery Systems	Ensure Ongoing Availability
Develop Technical Architecture Blueprint	Identify Gaps In Needed Skill Areas	Resource the Plan	Execute/ Deliver	Loop Back to Visioning
	Measure Change Readiness of Staff and Management			

Source: Gartner Group

Key Issue: How should IT manage the skills transition?

To improve IT component and service delivery by investing in improving the competencies of IT personnel, organizations are increasingly turning to SBM programs. An SBM program is used to analyze current skills with needed IT ones (based on an organization's technology forecast), and to implement programs to address skills "gaps." SBM is a cornerstone of a "workforce change management" program, but a number of questions remain about this "infrastructure" investment. Many organizations have a difficult time showing payback, but most have a "gut feel" sense that it is worthwhile.

With budgets flat and infrastructure investments heavily scrutinized, SBM may be a difficult "sell," but organizations seeking to improve IT personnel efficiency and effectiveness, staff retention, morale and project response should begin the SBM process.

Reader Notes

Successful companies will create and regularly update a sourcing plan to determine how to best obtain the required IT resources and skill sets during the planning period.

Function Outsourced	Potential to:		Risk	Internal Assess-ment	Internal vs. External Cost	Augment/ Replace
	Reduce Cost	Add Value				
Mainframe Processing Only	Low	Mod.	Low			
Data Center Tech. Support	Mod.	Mod.	Low			
Networking	Low	High	Mod.			
Applications Development	Low	High	Mod./High			
Applications Maintenance	High	Mod.	Low			
PC Infrastructure	High	Mod.	Low			
Planning/ Architecture	Low	High	High			
R&D	Mod.	High	High			

Source: Gartner Group

Key Issue: When should an organization outsource based on human resource issues?

IT organizations will constantly have to weigh the buy vs. build decision from an HR perspective throughout the transition to client/server. A full analysis should take into account the ability of resources (internal and/or external staff) to meet efficiency and effectiveness measures, the fully burdened cost (i.e., benefits, training, ramp-up time or opportunity cost) of each resource, and the risk involved in using each source.

Management should be benchmarking constantly to improve HR competencies and/or to source based on appropriateness of the resources fit with the project profile. We believe that most organizations will be forced to increasingly consider external sources not because internal personnel cannot learn new skills but rather based on time-to-market constraints, the sensitivity toward FTEs and the need to meet peak demand during the period of heavy migration to client/server technologies.

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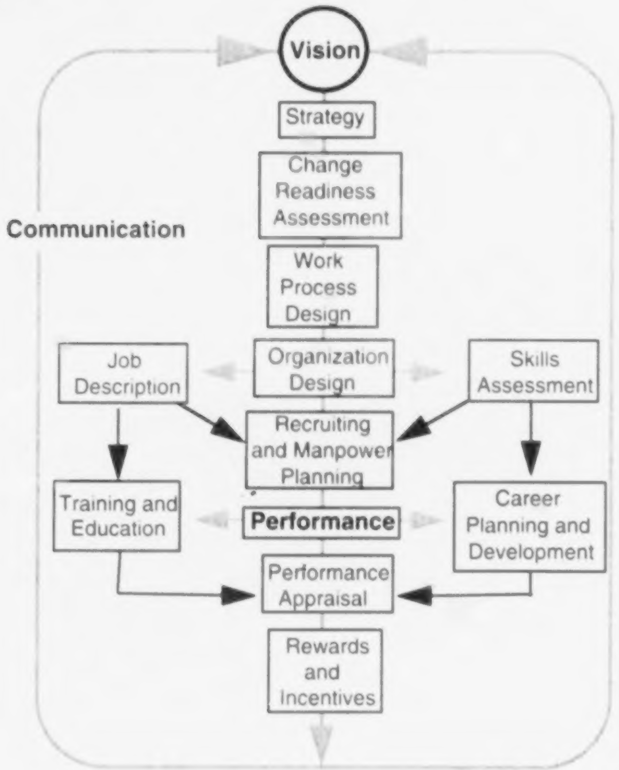
Imperative

To increase chances of success in re-engineering IT, IT management must approach re-engineering from a holistic standpoint.

Reader Notes



Vision

Strategy

Change Readiness Assessment

Work Process Design

Organization Design

Job Description

Skills Assessment

Recruiting and Manpower Planning

Training and Education

Performance

Career Planning and Development

Performance Appraisal

Rewards and Incentives

Communication

Source: Andersen Consulting

Key Issues: What processes can be employed to re-engineer IT human resources?

There are a number of different approaches that can be used to re-engineer IT human resources. However, we have found that organizations that use a piecemeal process end up compromising their success, as each element of an IT human resources program is dependent on one another. For example, implementing a 360-degree appraisal process without changing compensation practices in one firm minimized the impact that the 360-degree process had in changing behavior in certain professionals. Without an economic penalty or incentive, the employees did not "respond" in the end to feedback being offered through the review process.

Management must start with a strong vision for the organization and the individual IT professional, defining their role, needed skills and placement in the organization. From here, their incentives and appraisal must be re-engineered, and management must make appraisal an integral part of the day-to-day management objectives.

Bottom Line

Reader Notes

Attributes and Principles of Best-In-Class IT Workforce

- Market-Focused and Business Savvy
- Able to Change Quickly and Adapt to New Market Realities
- Can Demonstrate Business Return
- High Retention Rates (For Those Professionals Management Wants to Retain)
- Provide Leadership
- Team-Oriented "Firm First" Thinking
- Obsessed with Quality, Service and Continuous Improvement
- Innovative
- Self-Motivated and Entrepreneurial
- Proactive and Calm not Reactive and Chaotic
- Consultative
- Excellent Communicators
- Know-How to Balance Speed With Optimization

Even though there is a dearth of empirical methods to measure which are the best IT performers, organizations we have interviewed still feel that they can identify and attach certain attributes to top IT performers. Although the above listed attributes may differ based on the job that a professional performs and the culture of an organization, these attributes were cited time and time again during our interviews.

It is interesting to note that in many cases managers and staff that we speak with list attributes that are nontechnical in nature more often than technically oriented attributes in describing best performers.

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To more effectively manage IT service performance, IT management must re-engineer current IT human resource practices and do the following:

- Articulate an organizational vision
- Redefine IT work roles
- Re-engineer compensation and incentive systems
- Develop career alternatives for IT professionals
- Build a continuous learning environment
- Educate senior management and HR about "market" changes
- Educate staff about market changes
- Implement skills-based management programs
- Develop sourcing scenarios and transitional sourcing contingencies
- Initiate the workforce change process
- Build communications processes

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CONFERENCE EVALUATION SUMMARY

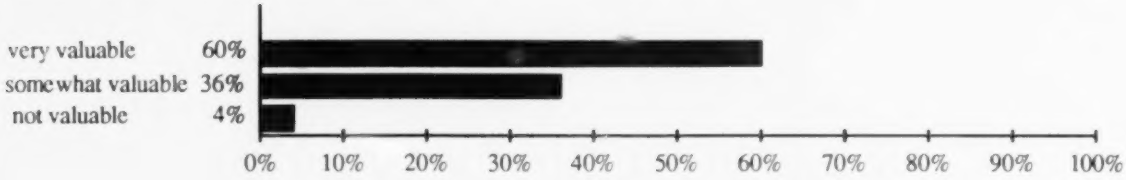
Summary of CAUSE95 Conference Evaluations

386 Evaluation Forms turned in

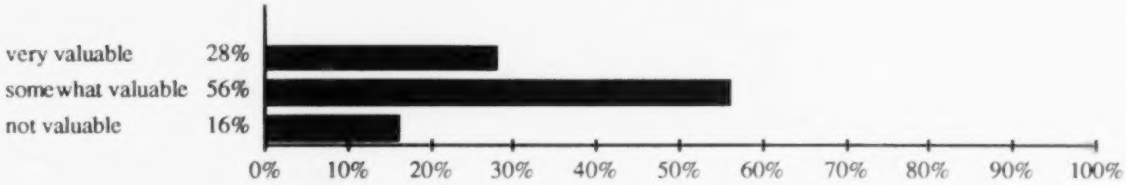
Note: full evaluation comments are available on-line at: http://cause-www.colorado/conference/cause95/cause95.html

Rate the following CAUSE95 activities in terms of their value to you:

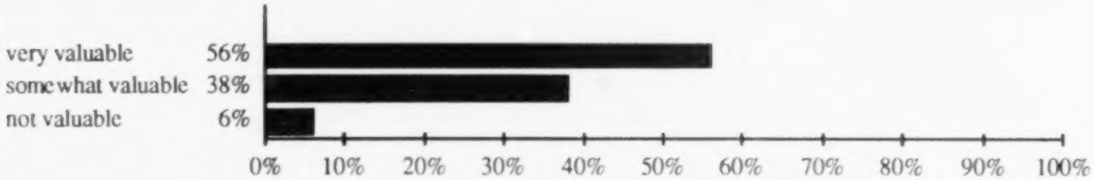
General Session by Ann Rhoades *(343 responses)*



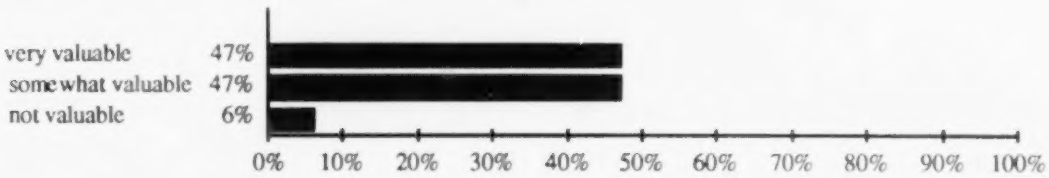
General Session by James Johnson *(303 responses)*



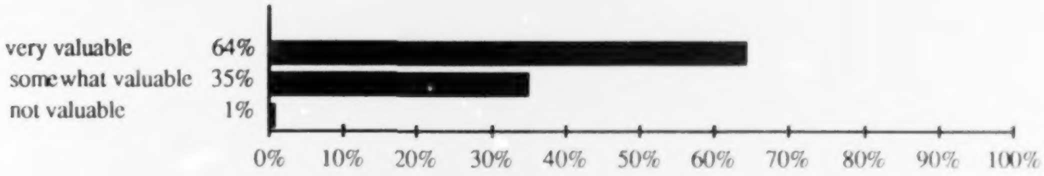
General Session by Clara Adams-Ender *(159 responses)*



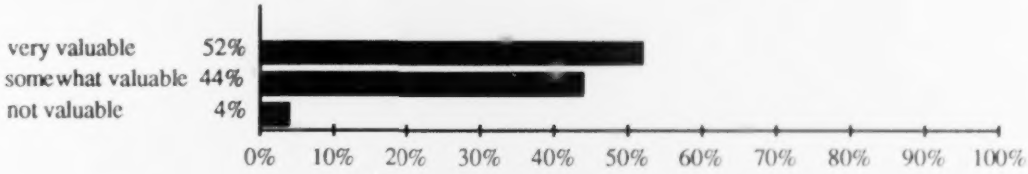
Current Issues Forum *(237 responses)*



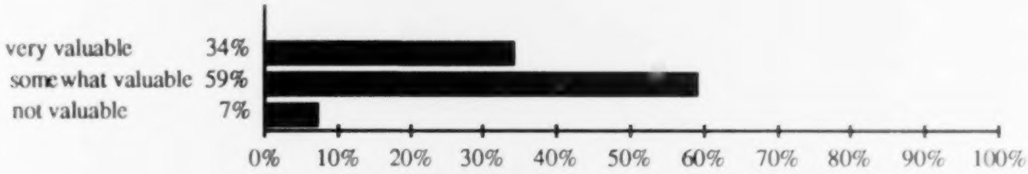
Track Sessions *(367 responses)*



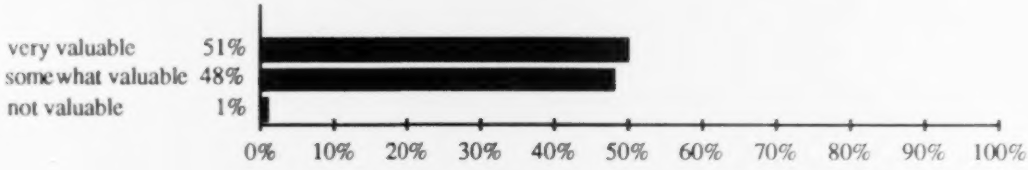
Focus Sessions *(221 responses)*



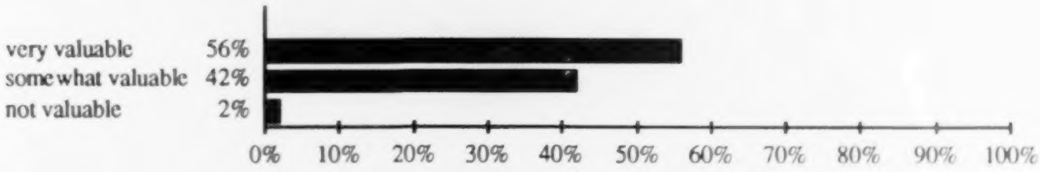
Poster Sessions *(254 responses)*



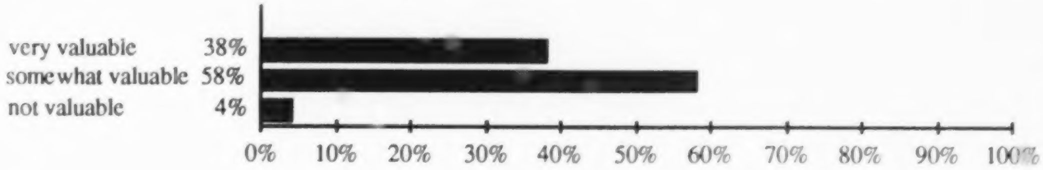
Current Issues Sessions *(203 responses)*



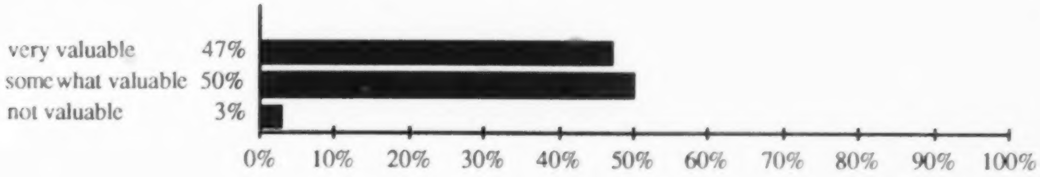
Constituent Group Meetings *(169 responses)*



Corporate Presentations *(255 responses)*

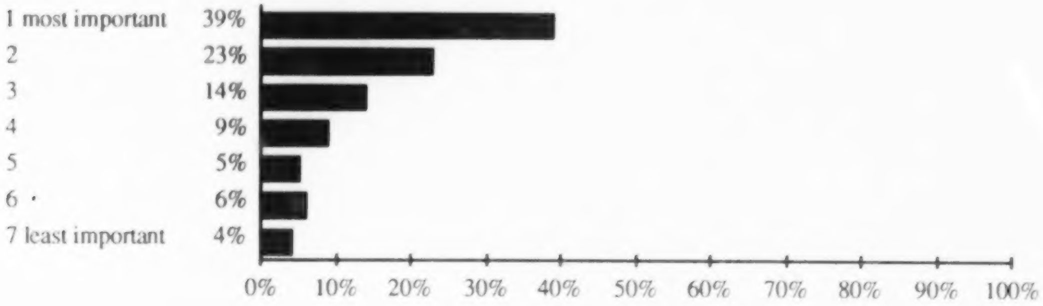


Corporate Demonstrations *(304 responses)*

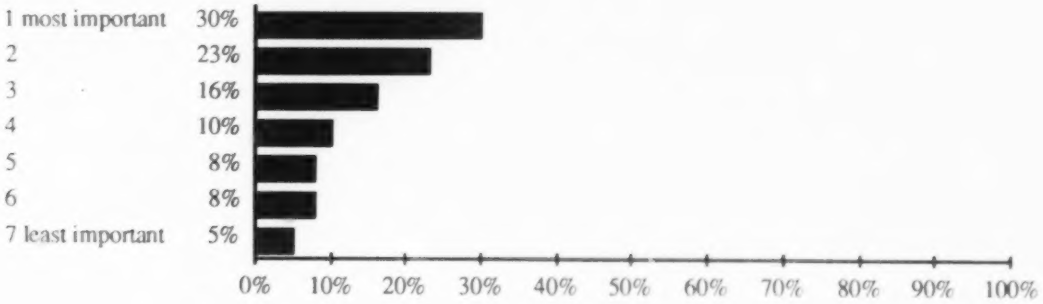


What made you decide to attend CAUSE95? On a scale of 1 to 7 (1 being most important, 7 least) rate each of these factors in their importance on your decision to attend.

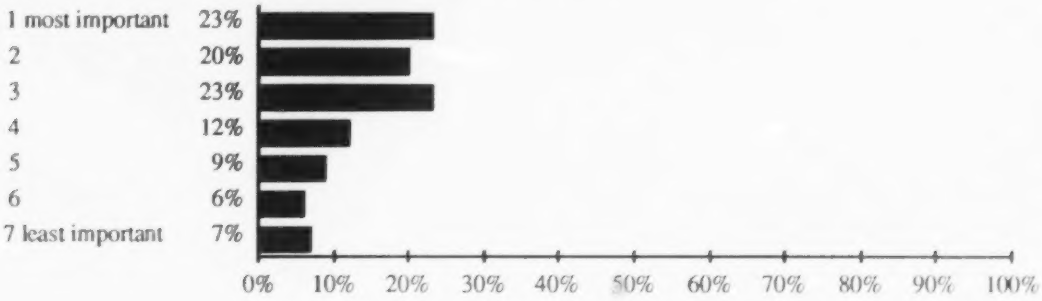
Program Content *(355 responses)*



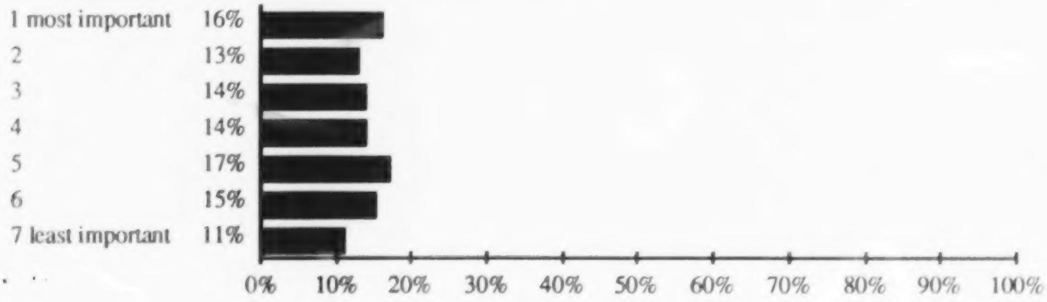
Professional development *(350 responses)*



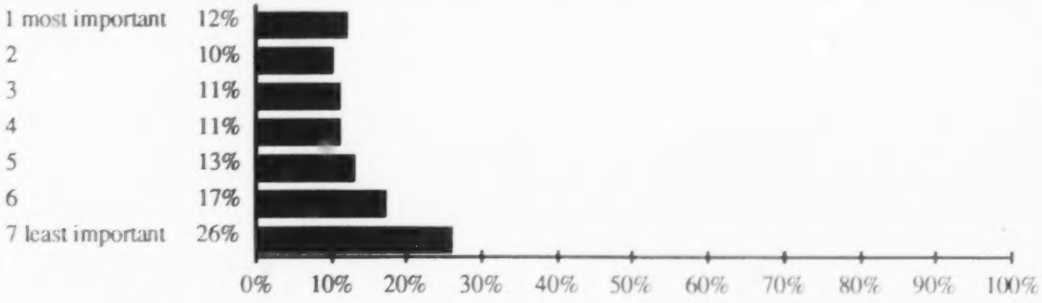
Networking with colleagues *(351 responses)*



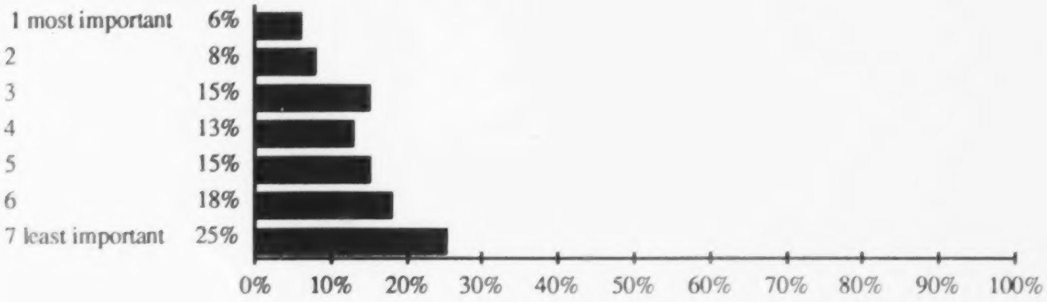
Identification with CAUSE *(335 responses)*



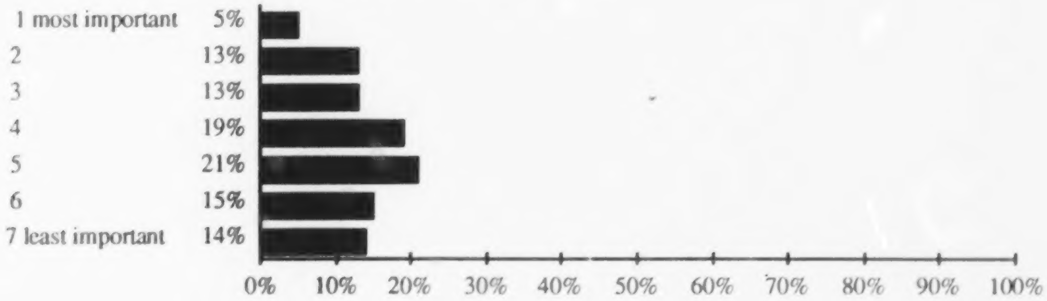
Peer recommendation *(332 responses)*



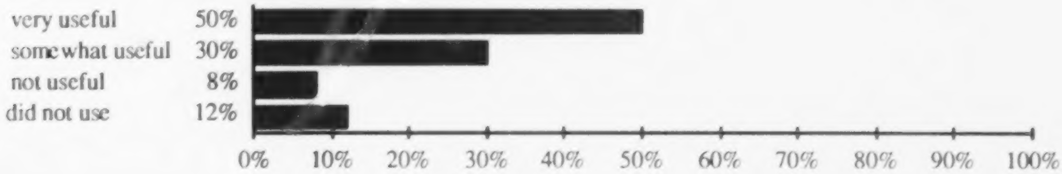
Conference Location *(345 responses)*



Corporate demonstrations *(335 responses)*

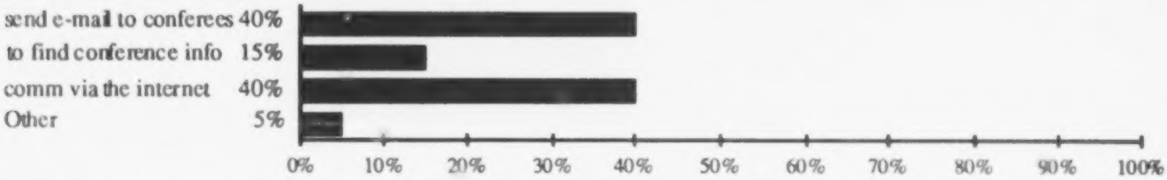


How useful did you find the CAUSEnet e-mail message system?*(351 responses)*



- Lines too long (7)
- Excellent, wonderful, etc. (3)
- I liked having access to the CAUSE Web site here.
- Never could get it to let me in — 7 tries.
- Like to see POP3 service available as well
- No DNS entries for UK sites
- I used CAUSENet to review sessions I did not or was considering attending.
- Not used by enough people.
- At this stage we don't have a way to get into our Group system (on Novell net) from off-campus.

How did you use the CAUSEnet e-mail? *(297 responses)*



What topics/speakers would you like to hear at future conferences?

Topics

- Client/server, applications (9)
- Networking/new networking technologies/network security (8)
- Data security/network security software/Web security (8)
- IT benchmarking, standards, IT costing and benchmarking (8)
- More in depth methodologies, solutions (3)
- Current and future technologies and experiences implementing them (3)
- Internet is certainly a hot topic to continue (3)
- Convergence of services--Libraries, computing, etc. (3)
- Topic selections are always pertinent and timely, good job on topics (2)
- More of the same: new technology, case studies, and human issues (2)
- More strategic information (2)
- More small college related topics (2)
- E-mail and group ware (2)
- Successful funding and budgeting approaches for IT (6)
- Policies/legal issues (3)
- How are others dealing with equipment replacement
- IT professional development/training/developing staff (11)
- Web development, applications, design issues (17)
- More distance learning/instructional technology--policies, curricula, technology (6)
- Faculty perspectives/needs from IT (4)
- Maintaining/creating relationships between IT organizations, their institutions, and the greater community (4)
- Student IT needs (2)
- Reengineering, reorganizing IT, funding for reengineering, case studies (8)
- Process for projects/planning, etc. (3)
- BPR techniques, methods (2)
- How to create/move to enterprise data (2)
- Data warehousing, EIS, data administration, data access methods (8)
- Enrollment systems

Speakers

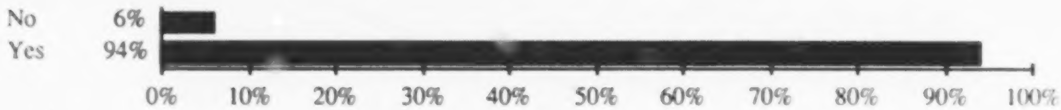
- Carl Jacobson was outstanding!, intriguing (2)
- Carole Barone (2)
- Bill Gates, CEO Microsoft (2)
- Meg Wheatley
- Don Tapscott
- Have Robert Wedgeworth as a General Session speaker.

- Philosophers like Toffler, Smith
- Enjoyed Ann Rhoades, and Jennifer James last year. Please actively search for speakers who are dynamic and engaging presenters.
- Jennifer James, cultural anthropologist. Excellent speaker (I don't think she's been at CAUSE).
- Peter Black
- Charles Wang CEO/CIO Computer Associates
- Hal Varian on economics of information
- Roy Pea on collaborative learning
- Steve Jacobson or Colin Powell would be great, but probably too expensive.
- SYNGE as a keynote speaker
- Economists
- Political figures
- Motivational speakers
- Personalities
- Major IT executives
- This is the whitest group I have seen in a long time. Do we need to have a session on recruiting and managing a diverse workforce? Or have we hired minority IT people who just haven't reached the Director ranks yet?
- Keynote speakers should not be chosen if their topic is not IT related; we get enough of this in the track sessions.
- Prefer someone outside of education field
- I would like to hear someone from the Federal Government talk about issues like continued free access to the Internet, privacy versus censorship, and any plans the government has to regulate access to information.
- More top level CEO's to give vision and guidance for IT at a broader level
- Someone from a large information tech firm on future direction of computer technology.

Do you have any comments about the site of CAUSE95?

- Great, excellent, good, fantastic, very nice, love it!, wonderful (77)
- Too small, too crowded, not enough seating, not enough presentation space (60)
- Some conference rooms not big enough. Had to stand or sit on floor or attend 2nd and 3rd choice presentations more than once. (13)
- Shuttles worked well (7)
- Conference is getting too large for a hotel. Should consider moving to a larger venue (convention center). (2)
- Temperatures a problem: too hot or too cold (4)
- The HEC presentation room was terrible--poor sound, poor video (2)
- Good hotel location--near sightseeing and restaurants, good accommodations. (13)
- The Hilton service was great. (7)
- Hotel too expensive (3)
- Excellent, good, etc. (28)
- I prefer warm sites this time of year! (2)
- City a little tough on keeping all conferees close (2)
- Good food and service. (2)
- Not enough variety in refreshments. (2)

Did you learn anything at CAUSE95 that may affect the way you do things at your institution? *(305 responses)*



General

- Web development, policies, applications, etc. (41)
- BPR, Reengineering strategies, ideas, etc. (12)
- Client/server implementation, applications, etc. (9)
- Strategic planning (8)
- Involving, training faculty and students (7)
- New ideas, approaches (12)
- Data warehousing tools and strategy (5)
- Confirmation of my conclusions on several things (5)
- Approaches to managing change (4)
- Use of WWW in instructional/course offerings (3)
- OLAP/EIS (3)
- New technologies (2)
- Staff training and development (8)
- Personnel management (7)
- Skills matrix from Liz Murphy's talk (4)
- Managing relationships (2)
- Leadership skills (3)
- IT/library collaboration issues and implications (4)
- Distributive support (7)
- Customer support (2)
- Networking (3)
- Security (8)
- Policies and planning (5)
- Ideas on managing customer expectations (4)
- Use of Legacy systems (2)
- Help desk management (2)
- "From the library perspective, I found much encouragement. It was a positive experience which I hope I can take home and spread to my peers in the library, in the computer center, and in other IT organizations on campus."
- "I'm not alone--now have a network of helpful colleagues to both commiserate with and encourage!"

  "I keep finding presentations about my current concerns. I pick up ideas and insights that will support my actions. This is my fourth participation and this has been true every time."

What changes would you like to see in future conferences?

- Very little. Good job. (2)
- Some rooms too small; need accommodations for larger crowds, more seating. (27)
- Survey attendees on interests in track sessions to determine appropriate room size. (7)
- Preregistration for sessions. At times some sessions were too crowded. (3)
- Big problem with getting into several presentations because the rooms were too small.(3)
- Refreshments before conference in morning and between track sessions. (3)
- Provide meal options for people with dietary restrictions.(2)
- Provide coffee alternatives.(2)
- As it was difficult to get into some of the more popular sessions, it would be helpful to extend the conference to 3 full days offering repeats of some of the oversubscribed sessions. (3)
- More time for sessions. Forty-five minutes is not enough. (3)
- Give guidance to presenters on improving visuals. (5)
- Require that speakers hand out some form of an outline of their presentation. (4)
- More skillful presenters.(2)
- A few sessions were misleading in their descriptions (2)
- No smoking. (6)
- More spousal participation or a way for them meet other spouses. (2)

"I would like to say. . ."

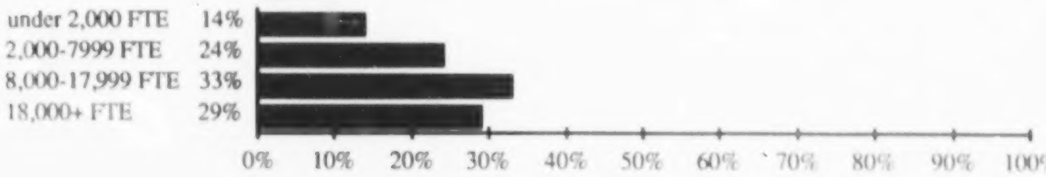
- Thank you! (9)
  Good, wonderful, excellent, etc. (8)
- "Thank you to all those who made this conference such an enriching and positive experience (exhausting as well) for me as a professional in IT and also as a person."
- "The CAUSE staff does a great job. Overall, I enjoyed the conference and had a valuable learning experience."
- "That CAUSE continues to challenge me to think in new ways--ways I don't normally take time for during the day-to-day stress back at the office. I appreciate the tremendous professional development opportunities and the broadening of my horizons."
- "CAUSE95 provided excellent mix of technology, interaction, professional development and entertainment."
- "With limited travel funds, it's great to find one conference that offers a high quality program across a breadth of IT topics--user services, change management, client/server; CAUSE is professional development money well-spent!"
- "Outstanding! This was my first CAUSE. I am new to higher education and found CAUSE95 to be a wonderful introduction and orientation to the community as a whole. A great opportunity to meet new colleagues working in the same areas of IT and with the same issues. A perfect place to validate your strategies."
- "CAUSE continues to be one of the most cost-effective ways to examine broad aspects of IRM in supporting the changing needs of the institution."
- "Thank you! This is the best run conference I have ever been to. You treat everyone very well--the registration went smoothly, the sessions also. It was a treat to be a speaker here. I really liked having people assigned to introduce, setup, and even the lights so we only had to concentrate on our presentations. Your technical staff did a wonderful job of orienting us and getting everything set up and they responded quickly and cheerfully to last minute calls."

- “Thanks--this was my first and I did find a couple of sessions of interest even though it is geared to people with very different responsibilities.”
- “CAUSE is without a doubt the best professional organization our institution belongs to--the CAUSE conferences are extremely helpful.”
- “Bravo a Jacqueline Brown pour ses mots de bienvenue en francais! The separate flyer with the program summary and the location of rooms is a great idea, very handy.”
- “Keep up the great work! Can we have graphical handouts at track sessions? They make note-taking much easier.”
- “CAUSE95 was very informative and helpful--I can’t wait to put some of the things into practice. Nice work--see you in June.”
- “The CAUSE staff does a top notch job--period.”
- “More than any previous CAUSE meeting (11 years worth) I was disappointed by the number of papers that did not seem to match their abstracts. I would expect a particular topic to occupy perhaps 40% of a talk, only to have it receive only passing mention. Other people I talked with had similar experiences. Please encourage presenters to update their Web-posted abstracts as they’re working on and perhaps revising their presentations. Please keep on making lots of information over the Web. Thanks for extending vendor exhibit hours, and for scattering corporate presentations throughout the conference, as opposed to a single time slot. Overall, the arrangement of the schedule at this year’s conference was the best I’ve experienced. Thanks.”
- “Thank you for providing lunch on the first day--at first we were told it would not be provided. Made things very smooth. Many presentations/presenters had trouble with the sound system--too loud/too soft, feedback. BIG distraction! Overall, a tremendous conference as usual--too much to absorb and comment on at once. I’ll go home and digest for a while.”
- “This is the first time, in 17 years of computing management, that I have felt that my own institution is slipping behind in relevance, ability to change, ability to sustain long-term viability. I go home deeply troubled about my own role and credibility, and about the future access to higher education for people of my region.”
- “The handling of the Thursday dinner was extremely regrettable. CAUSE schedule said 7 pm to 10 pm. At 8:30, the food tables were cleared. Thanks for no dinner for myself and several colleagues who arrived together.
- “Great organization of conference--sessions, handouts, evaluations, etc. Thank you for posting and sending preconference session tracks ahead of time. The Web page was extremely useful, when it was available. The weather forecast was a nice touch.”
- “Another winner! Great conference! Every year I think maybe I should attend another conference, but there is none that comes close to the quality and variety of topics covered and presenters.”
- “My career was greatly enhanced by implementing those ideas I learned at the national CAUSE conference and through networking with the CAUSE members.”
- “Thank you for a great conference.”
- “Congratulations to all CAUSE members who made this conference a positive and worthwhile conference for me and all attendees. This was my first CAUSE conference and I sincerely hope to be able to come again. Thank you!
- “Thank you very much. Job well done. I enjoyed the conference and found it very useful.”
- “The conference was positive, upbeat, exchanges were provocative at times.”
- “This is probably one of the best run organizations I have ever seen. Your job is difficult and challenging and you do it well! Thank you.”

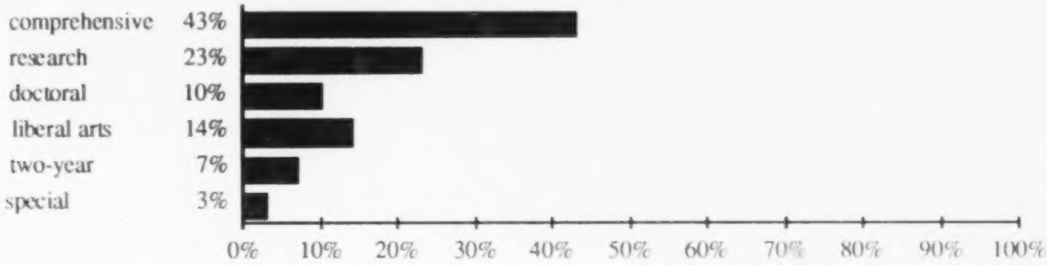
- "Please don't forget that the community includes faculty, students, and administrators as not only end users, but as artist/creator/facilitator who desperately need the best tools for the best results."
- "There was so much valuable information at this conference. My biggest challenge was trying to spread myself thin enough to attend all of the sessions on my list."
- "The CAUSE committees did a fabulous job--this was my first CAUSE conference but hopefully not my last!"
- "CAUSE is a great organization with high quality and professional service. It's obvious the CAUSE staff works very hard as a team to serve its numbers and to help lead in IT Professionalism."
- "The CAUSE staff is great!! Give them a raise."
- "I am a native of New Orleans. I appreciate that CAUSE95 wanted to give a 'flavor' of the city at the socials, receptions, breaks, etc. My advice is that if you wish to display cultural elements (and present snippets of dialect), take the time to get them right. Unfortunately that didn't happen. To borrow a line from James Johnson's talk, the cultural attempts resembled the real thing about as much as a greenpicked tomato shipped from California resembles a homegrown, vineripened one."
- "This conference give me a chance to get away from the trees and think again about the forest."
- "I'm a first-time attendee and enjoyed it very much; would like to bring more of my staff in future years--please do what you can to keep costs down."
- "It's interesting to note that American institutions have many of the same problems as those in Australia. CAUSE is an excellent means of sharing our problems, and importantly, our solutions!"
- "What a marvelous way to renew contacts, and acquaintances and establish new contacts in your own areas of interest. I once again found the 'out of session' discussions I had as valuable as the sessions."
- "CAUSE continues to provide an annual opportunity to come to a first-rate meeting where management oriented learning experiences abound in a most pleasant location."
- "CAUSE provides the foundation and forum for the exchange and development of innovative ideas and activities that are critical to higher ed."
- "This was only my second CAUSE meeting and I enjoyed it very much. I appreciate the smooth logistics (except for the room problems), and I appreciate the efforts to make attendees feel welcome."
- "You folks are doing a great job."
- "Well done (again).
- "Thanks for a great conference. . .mind-expanding!"

Demographics of the 386 responses

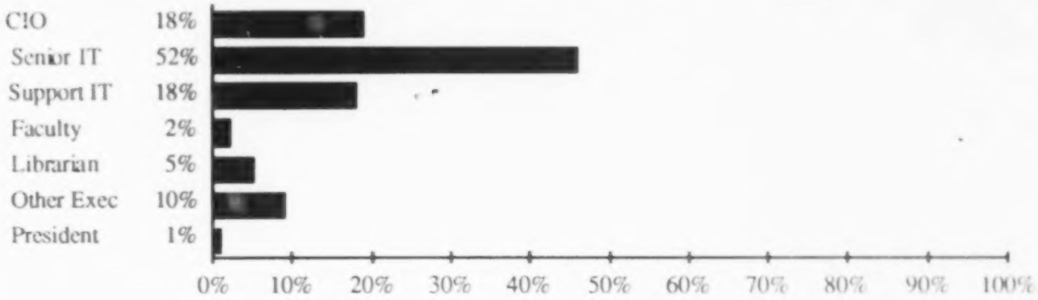
The size of my institution is: *(376 responses)*



My institution is classified as: *(373 responses)*



My job title falls in the following category: *(373 responses)*



CAUSE95 Videos

Video tapes of the three CAUSE95 General Sessions and the *ELITE* Award presentation are available through the CAUSE Information Resources Library for $25 each (member price; non-members, $50). The videos are unedited and real-time recordings, varying from 45 minutes to 1 hour in length. Order by phone (303-939-0310), fax (303-440-0461) or e-mail (orders@cause.colorado.edu).

Sixth Annual CAUSE ELITE Award Presentation

Carole A. Barone

Associate Vice Chancellor for Information Technology, University of California/Davis

VID0024

The CAUSE *ELITE* Award for ***E***xemplary ***L***eadership and ***I***nformation ***T***echnology ***E***xcellence is a lifetime award that recognizes top achievers whose accomplishments will have a significant effect on the profession CAUSE represents and on higher education in general. This video includes both the footage honoring Dr. Barone and her award acceptance speech.

Dr. Carole Barone, in little more than ten years as an information technology leader, has become an influential force in harnessing information resources to the service of higher education. She has orchestrated transformations in two universities she has been affiliated with, as well as significant professional initiatives, with humor, creativity, hard work, and a deep commitment to the importance of dedicated staff.

Barone began a 22-year tenure with Syracuse University in 1969 as assistant to the comptroller. She served Syracuse as University registrar, director of student data systems, and, ultimately, as vice president for information systems and computing. During her six years as the University's CIO she and her staff created a campus network and established a University-wide computer literacy program for all freshmen; by the time she left Syracuse all administrative information systems were online and interactive. Upon moving to the University of California at Davis in 1991, Barone led the design and implementation of a distributed computing architecture and is now working toward creating a campuswide ATM network. She worked with the UCD librarian to develop a Center of Advanced Information Technology where faculty, staff, and students can explore leading-edge technologies. Her staff of 300 has built a reputation on campus for being proactive, responsive, and highly service oriented. Active in systemwide UC initiatives, she is a member of the UC Committee on Intercampus Use of Networking and Information Technology for Academic Purposes.

Apart from her roles at individual universities, her vision and energy have contributed to structures that advance goals important to all of higher education.

Barone challenges us to step across old boundaries and test new ideas, to be creative implementers of technology in support of teaching, learning, research, and the general operation of higher education.

The ELITE Award is sponsored by Systems & Computer Technology Corporation (SCT)

General Session: Ann Rhoades

Senior Vice President of Human Resources, Doubletree Hotels

Who Is the Customer?

VID0025

Adding a new dimension to the definition of "your" customers, Ann Rhoades discusses the effects of defining internal and external customers, and offers ideas for proactively gaining customers' commitment and dedication.

Rhoades is senior vice president of human resources for Doubletree Hotels and formerly senior vice president of Southwest Airlines' People Department. She has spent 25 years in human resources in banking, transportation, and hospitality areas. She describes herself as a cultural change agent: one who enhances a culture to make it more customer-service oriented both internally and externally. Among the important principles she identifies for creating dynamic service orientation are fostering strong, institution-wide teams; selecting employees with positive attitudes; and valuing common sense over "corporate handbooks."

General Session: James W. Johnson
Vice Provost for Information Technology, Emory University
The Future Is Now—What Do You Do When Dreams Come True?
VID0026

Most of us have dreamed of a future in which everyone has access to a powerful networked computer. As we get closer to realizing this dream, we are faced with the challenge of delivering on this promise.

To deliver on the promise of information technology in our colleges and universities, we must change the way most of us have thought and operated in the past. Organizational hierarchies no longer work. Adversarial relationships are replaced by partnerships, and the economics we learned in school are turned upside down. Above all, we must embrace technologies that transcend organizational boundaries. IT can no longer be put on top of existing practice, but must transform and change those processes. New technologies that allow us to change processes demand that we change the skills of our staffs. This talk offers strategies and examples of the feasibility of such changes.

Over the course of his professional career, Johnson has chaired the economics department of Iowa Wesleyan College and directed Conduit, an educational software project supported by the National Science Foundation, and the Weeg Computing Center. In the past seven years at Emory he has directed the newly created Information Technology Division, consisting of the Emory Data Center, Network Systems, University Information Systems, Computer Resource Services, Telecommunication, and Multimedia Communications. For the past two years he has chaired Educom's Board of Trustees.

General Session: Clara Adams-Ender
President and CEO, CAPE Associates
Caring About People with Enthusiasm
VID0027

Bringing her message of caring and its impact on management, quality, and productivity, Adams-Ender elaborates on the important aspects of management: Commitment, Action, Responsibility, Integrity, eNcouragement, and Giving—or **CARING**.

Born in North Carolina as the fourth of ten children, Adams-Ender rose from a staff nurse in the Army Nurse Corps to become CEO with the rank of brigadier general and management responsibility for the Army's 22,000 nurses serving all over the world. General Adams-Ender managed policy development for over 100,000 health care professionals as director of personnel for the U.S. Surgeon General, and has served as base commander and mayor for Walter Reed Army Medical Center.

Through her leadership of CAPE, General Adams-Ender expresses her belief that motivated, well-trained people who care about themselves and others are the essence of a truly productive, quality-oriented workforce.

CONFERENCE CASSETTES

CAUSE95 · Recorded Live · November 28-December 1, 1995 · New Orleans · Program 9561R

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☐ TAPE 3	UNIVERSITY INFORMATION SYSTEM STRUCTURES & POLICIES - Bruce Rocheleau
☐ TAPE 4	THE REALITIES OF CLIENT/SERVER DEVELOPMENT & IMPLEMENTATION - Mary Ann Carr & Alan Hartwig
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☐ TAPE 6	THE USE OF GROUPWARE IN THE REENGINEERING OF BUSINESS PROCESSES - Richard M. Kesner
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